JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOLUME 34 APRIL 15, 1944 No. 4

ETHNOLOGY.—*Sanitation and health in a Japanese village.*[1]

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INTRODUCTION

The present war in Asia has caught America with an acute shortage of first-hand, reliable knowledge of many aspects of Japanese culture. One such aspect is that of sanitation and health, as the writer has discovered in connection with instruction in an Army Civil Affairs Training School. For this reason the available first-hand data on the subject, as they apply to a specific community in Japan, have been brought together in this paper.

Suye Mura is a small country village in Kyushu, the inhabitants of which gain their livelihood largely through cultivating paddy field rice and to a lesser extent through raising silkworms.[2] Though a long way from Tokyo, it is not too far from Nagasaki and Kumamoto City, where there has been a long history of contact with the West. Its standards of health and sanitation, while considerably more backward than those of the town or city in Japan, probably do not differ basically from conditions in other villages. The relative shortage of doctors and the high consumption of patent medicines, for instance, are reflected in the national statistics, which show that in Japan there is an average of 7.65 doctors for every 10,000 people,[3] approximately half the figure for the United States, and that for patent medicines there is an annual expenditure of about ¥130,000,000.[4]

CIVIC PROVISION FOR SANITATION AND HEALTH

There is in the village office a sanitation bureau and in each hamlet a special person concerned with matters of sanitation, the *eisei kumichō*. Frequently he is the same person as the hamlet headman (*buraku nushidōri*) or the head of the hamlet agricultural association (*buraku kokumiaichō*). He may hold his office either through election or by a system of rotation. His chief functions are in connection with house-cleaning examinations and vaccination. There is also a cemetery overseer whose duties are to check on the condition of graves and see that they are deep enough to prevent dogs from digging in them. He is also charged with the duty of preventing any illegal exhumations and seeing that no body is buried sooner than 24 hours after death. This last rule is to insure against burying someone alive through an error in diagnosis of death. The village office also maintains on its rolls a doctor for the purpose of preconscription health examination for boys from the village and an annual smallpox vaccination at the village school.

All these functions are only occasional duties of the persons concerned. The sanitation officers are mostly regular farmers, as is the cemetery inspector. The doctor lives and carries on his practice in a nearby town, coming to Suye only when his duties as Suye public-health doctor demand it.

The local police assist the village officials in the carrying out of their public-health duties and of course may be called upon to enforce any rules which are not obeyed. The need for this, however, is rare.

[1] Received February 26, 1944.

[2] The data given here were collected in 1935 and 1936. A description of social life in the village may be found in *Suye Mura, a Japanese village*, University of Chicago Press, 1939.

[3] Japan Year Book, 1939–40.

[4] Far East Year Book, 1941.

STANDARDS OF CLEANLINESS AND HEALTH

Standards of cleanliness in the village are different from those in, say, an American small town. They also vary considerably according to local standards from individual to individual. In house-cleaning, for instance, it is essential that the straw floor-mats (*tatami*) be kept clean. On the other hand, the use of the same dishrag day after day, both as dishrag and as towel, is also considered quite proper. The average farmer takes a bath practically every day, but runny noses among the children pass unnoticed and are considered no offense. In regard to local variations, the upper-class groups, who incidentally are better able to afford cleanliness, are likely on the whole to observe strictly the traditional Japanese standards of hygiene. In regard to drink exchange, while in the towns, as a rule, the drinking cup is rinsed off in a bowl of water between exchanges, no such refinement is observed in the village.

The hair of young girls and even of adult women is often infested with lice. Most of the farmhouse *tatami* contain a peculiarly aggressive form of flea (*nomi*).

Within the Mura there is a fairly wide range of knowledge and practice in regard to matters of sanitation and health according to social and occupational status. One or two of the more well-to-do individuals who have been away to college, the midwife, and a few others have a much better comprehension of the cause and prevention of disease than does the average villager. Similarly, shopkeepers and schoolteachers, with their wider knowledge of the modern world than the person who rarely travels, are not so likely to follow traditional folkways.

PLUMBING

There is no plumbing of any sort in the village, water being obtained from wells and streams. Night soil and manure are carefully preserved to be used as fertilizer in the fields, and there is practically no garbage to be disposed of. There are, for instance, no meat bones in the village, because the people eat no meat. The carcasses of dead animals, such as horses, are bought up by certain people in the towns for the use of the hides and the bones. Bean-curd (*tōfu*) waste is fed to the pigs kept by the *tōfu* makers. The pigs in turn are sold to city dealers.

The bath and toilet of the village farmhouses are not a part of the main building but are usually in the form of outhouses somewhere in the house yard. There is usually a bucket set in the ground to serve as a urinal somewhere in the front yard near the structure housing toilet and bath. It is used by the men much as in the Occident, while women stand over it facing the yard, bending forward and hiking the garments to the knees in such a way that they may urinate without either soiling their garments or exposing themselves. The urinal is only partially protected by a doorless wooden covering; sometimes it stands quite in the open. A branch of evergreen may be placed across the top to serve as a deodorant. The outhouse toilet is enclosed and has a door. It is used in such a way that one squats over an opening rather than sitting, thus avoiding any spread of disease by means of toilet seats. There is no plumbing attached to either the bath or the toilet. The bath requires filling with water and heating by a fire built underneath it every afternoon. The same bath water is used, as a rule, by the whole family or even by several neighborhood families in order to save the work of filling several tubs and laying several fires. However, the general practice is to wash one's self off first and then get into the tub for a hot soak.

The water is supplied from wells in yards and ditches or from nearby fresh-water streams and springs. As a rule, most water is taken in the form of soup or tea and so has been sterilized through boiling. Dishes and trays, however, are washed in cold water.

REFRIGERATION

There is no refrigeration in the village, although it does exist in the small towns of the area. A man, such as the fishmonger or the ice-cake[5] maker, maintains refrigeration from natural ice or from refrigeration apparatus. However, even in the towns, refrigeration is restricted to such special occupations and is not a characteristic of

[5] A kind of "popsicle."

the average household. Cases of illness resulting from eating contaminated ice cakes are occasionally reported in the towns.

HOUSE-CLEANING

Daily house-cleaning includes the rubbing off of the *en* or wooden runway by one side of the house and the sweeping out of the front yard or the dirt road in front of the house. In fact, the day usually begins with a brisk sweeping of the dirt yard or road to be followed later by a hasty dusting of the interior. Dishes are washed in cold water, the same dishrag being used for both washing and wiping. Since there is no greasy material in the local diet, this cold-water washing is sufficient to keep the dishes presentable. Trays and other eating utensils, which are only used from time to time for special banquets, are usually washed just before using rather than when being put away. On dusty days, the roadway in front of the house is sprinkled with water.

In Japan it is the rule that houses must be cleaned two or three times a year, and in Suye the dates come in April and July. The lack of a house-cleaning period in January or February may be due to the cold weather. House-cleaning, which is woman's work, consists in removing the paper sliding screens (*shōji*) and removing the *tatami* and other movable parts of the house and taking them outdoors where the *shōji* are washed off and the *tatami* beaten. The floor boards under the *tatami* are wiped and fresh bamboo branches are used to brush off the walls and ceilings. Movable objects and bric-a-brac are simply moved about while the surfaces on which they stand are cleaned, but the dust of the ages on the bric-a-brac itself goes undisturbed. On the appointed day, the village sanitary inspector and a policeman come around to inspect each house to see that it has been properly cleaned. A house must be pretty dirty not to pass. Each housewife is given some carbolic-acid disinfectant at this time to be put by the toilet, around on the dirt floor of the kitchen, and in the dirt areaway by the entrance, areas subject to wetness; the carbolic acid is intended to be used as a protection against epidemics as well as to kill insects.

Household bedding is laid out on the floor in the evening and rolled up and put away in a closet during the day. It is not unusual for a man to go to sleep with his regular clothing on, and school children often sleep in their school uniforms.

VACCINATION

The Japanese Government has for some years maintained a thorough program of smallpox vaccination, one that reaches out to include every village and hamlet of the nation. In Suye Mura, for instance, once a year, all the one-year-olds and all the ten-year-olds are gathered together at the school for this purpose. There is a check-up of those vaccinated a week later. The doctor employed by the village office performs the actual vaccinations. There have been no epidemics of smallpox in Suye Mura for over 30 years.

HOSPITALS

There is no hospital in the Mura, and as a rule villages are without such medical service. On the other hand, there is a small hospital in a nearby town run on a somewhat cooperative basis. Two of its councillors or trustees are people of Suye, one of whom happens to be the village headman. The rooms in this hospital, like those of many Japanese hospitals, are very much like rooms at home with *tatami* floors, and the bed is made up directly on the floor. It is the custom for relatives to visit a patient at frequent intervals and for long periods, even eating with him and helping to nurse him. As a rule, people from Suye Mura go to a hospital only when seriously ill, and many people who would be hospital cases by American standards never see the inside of a hospital room. Also, as might be expected, it is only the more well-to-do who go to the hospital, because of the expense involved.

There is a small isolation building in the village for the purpose of taking care of any person who should be taken down with a seriously contagious disease. It has not been used for that purpose, however, for 20 years.

DOCTORS AND MIDWIVES

There are very few doctors in these rural

areas, and there is no doctor at all in Suye Mura, though there are some in the towns and one in the neighboring village. One of these doctors may hold a weekly clinic in the Mura if he thinks it will be profitable. Doctors must certify to deaths for village office records, and such death certificates usually cost 25 to 50 sen. In regard to health matters, doctors are regarded as rather expensive by village standards since they charge 1 to 2 yen per visit. Furthermore, some of the older rural doctors are not especially well trained as medical practitioners. There is no dentist in the village, and people with serious tooth trouble must go to a town or city dentist.

A typical country doctor in this area is Dr. K, of Fukada Mura, a couple of miles from Suye. His degree of training is somewhat doubtful, but his success financially is beyond any doubt. His residence is an imposing one, and he makes his calls in a little Ford roadster, one of the very few motor vehicles privately owned by anyone in this area. He has a rather superior attitude in regard to the local farmers and by his own testimony does not like living in the country. He says that he buys ¥10,000 worth of medicine a year but only receives ¥2,000 for it. He makes his money rather as a landowner. These statements can best be understood by realizing that by Japanese standards it is more important to be from an old landowning family than to make one's money through trade. Nonetheless, the statement should be taken with considerable skepticism. Dr. K, like some other doctors, occasionally complains about the faith healers or *kitōshi* of the area, claiming that people go to them until the sickness becomes very serious before calling in the medical doctor.

There are two midwives in the village, women who have been trained in special schools and who are licensed to practice midwifery. They attend births and look after the mother.

A favorite doctor's remedy for pains of various kinds from boils to female diseases is the use of injections or *chūsha*. The villagers attach considerable value to these injections, and it is possible that they serve as a psychological substitute for such folk practices as *mogusa* and acupuncture described below.

When ill, most people simply stay at home and go to bed. A young wife may go to the home of her parents if she becomes sick. Only in extreme cases does one go to a hospital, and such extreme cases do not include childbirth. The family is likely to visit a faith healer or administer some home remedy as a first means of regaining health. The doctor is called, as a rule, only as a last resort, often when a man is on his deathbed.

FAITH HEALERS

Faith healers or *kitōshi* are men or women who, by means of prayer and incantations, cure illnesses, drive out evil spirits, and in general bring a sick body back to health. They may effect their cures with the aid of either Buddhist or Shinto deities. An Inari[6] *kitōshi* is especially popular in Suye as well as one old, blind healer who maintains a small, run-down Tendai[7] temple. The *kitōshi*, on the whole, do not belittle the use of doctors and medicines, and there are instances of their actually recommending that their clients go to a doctor for treatment. They have no set fees, people giving them gifts of rice, eggs, etc. Most *kitōshi* (and Shinto shrines) have for sale special charms and medicines for everything from horses' health to fertility in women.

Yakushi, a special Buddhist deity of medicine, is occasionally enshrined in local priestless hamlet temples (*dō*). While most ills are regarded as of natural origin, some sickness is attributed to witchery by means of an *inugami* (dog spirit) or *nekogami* (cat spirit) instigated by the malevolence or envy of some unpleasant neighbor. Such sickness, of course, would call for the immediate attention of the *kitōshi*. Some people patronize the faith healers regularly as a kind of health insurance.

MEDICINES AND PILLS

Medicines are much used in the Mura.

[6] A popular Shinto deity of good fortune, patron deity of farmers and of *geisha*. His messenger is the fox.

[7] A Buddhist sect formerly strong in Japan but today less important than such sects as Shinshu, Zen, and Nichiren.

Families may spend as much as a yen a month for medicine, and a single household may have on hand as many as seven to eight different medicines. There are very few, if any, legal restrictions as to what the label of a medicine bottle or box may say. Most of them claim the contents to be general cure-alls, and most of the purchasers believe what the label says.

The medicines are obtained from a number of sources. A few people purchase certain medicines from the agricultural association, and doctors frequently give medicines in connection with other services. There are also many druggists in the nearby towns who sell all sorts of medicines as well as a number of itinerant medicine sellers who go through the village from time to time. Home remedies of various sorts are also common.

Sometimes people visit hotsprings as a means of restoring their health. There are some small springs at Yunoharu, not far from Suye, a somewhat better one at Hitoyoshi, the old county capital 12 miles away, and occasionally someone from the village may go as far as the famous springs of Beppu, a day's journey by train.

ITINERANT MEDICINE SELLERS

A Korean peddler of ginseng or Kanton no ninjin.—This man comes through the village from time to time selling his wares and gossiping with the housewives. He says that if you are sick ginseng will make you feel better, and even a little bit will cure a fever. He also claims ginseng to be good for headache, cold, female troubles, gonorrhea, and syphilis and a cure for sterility. This wonderful medicine does not come for nothing, and the seller charges ¥7.50 and up per root. However, a little goes a long way, a bit of it being scraped off and boiled into an infusion, which is then taken internally. Ginseng, incidentally, is a Japanese Government monopoly in Korea.

Patent-medicine sellers.—There are a number of different patent-medicine sellers who pass through the village from time to time selling their wares. The practice is for

Fig. 1. *Beni* seller being given a cup of tea by a farmer's wife. The chart he holds shows how *beni* may be applied.

them to leave with a given housewife a number of pills and powders without charge, then to come back in six months or so, at which time the customer pays only for what she has used.

Beni *seller.*—*Beni* is a red liquid looking somewhat like mercurochrome, and there is a particular man who comes through the Mura from time to time peddling it from house to house. According to the *beni* seller, his product is good for many ills. If you have a fever, put it upon the soles of your feet; if you have stomach trouble, put some on the lower chest; if you have troubles of the womb, place some on the belly; if you have gonorrhea, put some on just above the sex organs; if you have arm or shoulder trouble, put some on the arm; if you suffer from headache or *histeri*,[8] put some on the temples and the crown of the head. *Beni* stings on application and leaves a bright red spot for a few days after application and so has a good psychological effect. Many people in the village use it, especially for headache.

COMMON TRADITIONAL TREATMENTS

Three common traditional treatments used in Japan are acupuncture, moxa, and massage. All three go back at least to early Tokugawa days, and in one form or another they are also practiced in the rural areas of Korea and parts of China. Most of these three treatments are performed by older women of the village who are regarded as experts.

Acupuncture.—This is a treatment involving the use of a needle in a bamboo sheath. A case description[9]:

> Mrs. K, wife of the Inari *kitōshi*, got a sore neck and shoulder. People suffer from stiff necks and shoulders and backs, very often—whether from overwork or rheumatism due to damp and cold winters I do not know. She came for a massage to Mrs. Sawada [an old woman of a poor farm family living in the same hamlet as Mrs. K]. The old lady is famous for it. At first she massaged her sitting down, then made her stretch out and pressed her neck stressing the sore spots. Then she used the needle—a metal needle blunt at the end which is put into a bamboo tube about 1½ inches long. She applied the tube to the sore spot, then by flipping her fingers got the needle, protruding on top at first, well into the flesh; then removing the case she twisted the needle. No blood appeared. The pain was said to be much relieved by the treatment. In her bag containing the massage material the old lady had a bottle of alcohol which she rubbed on her hands and the needle—she did not know why she did it but the old lady I—also present—said it was a disinfectant. But after the alcohol wash she passed the needle through her hair to make it glide, as is done in sewing.
>
> The old lady learned her trade herself, bought the needle at Taragi, gets a few *sen* for her services (*"kokoro kara"*—from the heart) from each patient.

It is to be noted in this case that the functions of the acupuncture expert and the *kitōshi* do not conflict. In a case calling for acupuncture even the wife of the *kitōshi* visits the proper specialist. The case also brings out the varying degrees of knowledge of different persons in the village. Old Mrs. S, a rather unsophisticated woman, wife of a farmer, has learned her trade from a specialist in the town more or less by rote as one would learn a magical formula—hence the alcohol is used as instructed, but she is ignorant of its purpose as evidenced by her own statement and by her subsequent action in running the needle she has sterilized in alcohol through her hair to make it smooth. Mrs. I, on the other hand, is the wife of a broker and business man and knows the purpose of the alcohol, though it is possible that even she did not see the inconsistency of running the sterilized needle through the hair.

Moxa (mogusa).—This is a cure involving the burning of bits of dried-up young leaves of the Chinese wormwood (*Artemisia moxa*) usually on the back and sometimes on thumbs held closely together or on the back of the hand. The burning of the skin is said to "take the pain away." A case description:

> In Nakashima I came across old Mrs. G having her back burnt. Her daughter-in-law was doing it. First she passed an iron rod through a pipe stem to get it stained, then, locating the sore spot by pressing her finger, she would make a small spot with the rod. After that she put a tiny bit of *mogusa* on all the marked spots and burnt it by applying a stick of incense (*senko*). Each spot was gone over and over again until one layer

[8] See below.

[9] This and the other case descriptions given below are from the field notebooks of Ella Embree.

of skin was burnt off. The burnt moxa was scraped off with a finger before applying more stuff. Through all this the old lady never uttered a sound. Yet when a bit of burning stuff was dropped by mistake on the wrong spot, she shuddered. They do not do it regularly, but say that if done twice a month the back would not ache at all.

Massage.—Massage is done both by hand and with special sticks. A case description:

Mrs. I of Imamura when I stopped there this afternoon was just having her last bit of massage. It was being done by a specialist from Menda who calls his massage *himeri*—moving of muscles to restore circulation, as against the common variety of *amma* ("as done by untrained people in the country") or massage done outside of Japan. He thinks his massage can cure many troubles—bruises, stomach diseases, skin eruption due to bad circulation. He knew something of anatomy and a few English terms he picked up somewhere (one of his brothers is in America now). He is also the representative of a medical manufacturer and sells just one brand of medicine and warns you against counterfeits. He has pills for internal troubles, *karumin* being the most popular and good for settling stomachs, counteracting constipation, overcoming diarrhea, preventing dizziness and curing headaches. He also has ointments. As premiums and ads he distributes two flags—a large national flag and a triangular navy flag both with company's trade mark on it. This trade mark is also represented in a gold-braided medal on his cap—which makes him look like a railway official. Took up this business because he has very poor eyes and could not do any studying.

He comes to the village regularly at certain intervals and has been coming more often now to give Mrs. I her treatment. She did not see me when I came and lay there moaning with pain, covering her eyes up with her arms. She was quite naked and had a kimono thrown over her. After the operation she looked all done in. But her skin is much better. The pills he left with her said (in English) "For gonorrhea, catarrh of the bladder and testicles." In Japanese there was a long description which mentioned gonococcus. To me she said nothing is the matter with her internally and the medicine is merely to clear the system out now that the eruptions on the skin are over and her blood circulates properly. She complained about the price of the stuff—one yen a bottle and the dose is thirty pills a day.

COMMON ILLS

There are a number of common ills that afflict the people of the village and that are for the most part accepted as a part of this world's inevitable misfortunes:

Skin diseases, rashes, etc., are very common, especially in children. One child's skin disease is known as *mizu bōsō*. Common remedies are ointments and powders. Rashes are especially common in hot weather, and more faith seems to be put into powders and ointments than in washing as a preventive or cure.

Colds and chest troubles.—These occur in both adults and children. Children go to an unheated school, which is regarded as good self-discipline for them. Infants are frequently subjected to exposure of various sorts in cold weather. When an infant wants to relieve himself, for instance, his mother lifts his kimono, opens the *shōji*, and holds him outdoors till he is finished.

What Dr. K calls influenza is also a common ailment in the village and a serious one.

One home remedy for a cold is garlic in soup or mixed with brown sugar. "Garlic is good for the health" is a common saying just like "wheat is good for the health." (The peasants do not like wheat in their rice, but when eating it as an economy measure console themselves with this phrase.)

Cerebral hemorrhage and stroke (Nōikketsu, nōshukketsu).—This is frequent among the old and is often fatal. The doctor is usually called in to diagnose an attack, but most of the care is by the family and at home. One doctor lays its high incidence to overdrinking. He also cites liver ailments as due to the same cause.

Chūbu, a kind of paralysis, is also common among the old people. (Hepburn translates *chūbu* as hemiplegia.).

Venereal disease.—Syphilis (*baidoku*) and gonorrhea (*rinbyō*) both occur in the village but do not seem to be especially common, judging by the fact that no cases were found by the army doctor among the conscripts in Suye in one year. However, these diseases are much talked about and form a favorite topic of malicious gossip. A specific case:

One baby died of congenital syphilis after a period of illness. According to the father: he read of some medicine in a magazine and sent for it; the baby recovered rapidly, too rapidly, for all the poison was not yet out of the body; this caused an explosion of the veins in the head and, hence, the baby died.

One remedy said to be good is a mixture of snakeskin and *shōchū* (a distilled rice

liquor). Some women say that *shōchū* is good for female genital diseases.

Stomach troubles and intestinal diseases.—These are especially common in children who eat irregularly and frequently overeat of starchy foods, such as the heavy rice cakes made on the occasion of various holidays. In fall, stomach trouble from eating green persimmons is common. *Ekiri*, a form of dysentery, is also common with children.

In the event of vomiting, due to indigestion or too much liquor, cold water is administered and the vomit is covered with ashes by one of the women of the household.

Backache, pains, stiff necks, stiff shoulders, and backs (rheumatism and arthritis).—These chronic ailments are especially common among older women. The chief remedies are massage, moxa, and acupuncture. (See above.)

Women's diseases, pains, and uterus troubles (fujinbyō).—Diseases and pains of the uterus (*shikyū* or *sh'kyū*) are especially bad and seem to be due to a lack of proper postnatal care. The midwife says that the women get up too soon after childbirth and do not take proper care of themselves. Local custom in this regard is described below.

Accidents.—Burns and cuts are common. Burns may occur from a child's falling into the *irori*, or fire pit. Such burns may be treated by a doctor or by some home remedy such as *kaki no shibu* (an astringent made from persimmons). Patent medicines may also be used. The bacteriologist Noguchi had one hand seriously damaged by such a burn.

Cuts may be treated by a doctor as, for instance, in the case of a boy falling from a tree and cutting himself. Cuts in the fingers and legs are especially common. One home remedy is salt and hot oil applied externally, as in the case of a young woman who had a cut from bamboo on her leg that had become swollen.

Cancer.—Cases diagnosed as cancer are rare, though the Zen priest died of cancer of the throat. With the relatively high death rate and low age expectancy, it is possible that cancer actually is less common in Japan than in, say, the United States. (The national statistics for Japan tend to bear out this statement.)

Leprosy.—Leprosy is rare in this area. There were no cases in Suye itself. Leprosy is regarded by the people as a disgrace to the family. It is very difficult for relatives of a leper to get married. Villagers regard leprosy as being due to bad blood and hence inheritable. According to one of the doctors in the region, mild cases are registered with the police and given an injection of some sort of oil (chaulmoogra?). More serious cases are sent to an isolation hospital in Kuroishibaru, Kumamoto.

Tuberculosis.—The incidence of this is uncertain though the national tuberculosis rate is high. Like leprosy, it is regarded as a disgrace to the family and so cases of it are likely to be hushed up.

Malaria.—According to a local doctor, there is no malaria in Kuma County. There were quite definitely no cases in Suye in 1935–36.

Typhoid.—This occurs in epidemic form in Kuma, according to a local doctor. However, there has been no incidence of it in Suye recently.

Insanity.—Insanity, like leprosy, is regarded as a family disgrace, and it is not mentioned if possible. People will simply say that so and so is ill or has a cold, etc. If a person becomes violently insane, he may be locked in a special room with the permission of the police, or he may be sent to a hospital at the medical college in Kumamoto. Mild cases are not treated in any special way. Insane persons do not get married.

Feeblemindedness.—This is usually taken care of at home. The feebleminded person is given simple chores to do around the house. Feebleminded persons rarely get married, though this is no guarantee that they will not have children.

Nervous breakdown.—Something resembling nervous breakdown occurs. It is due to worry and anxiety and occurs especially among women when marital relations are bad, work in the home difficult, etc. A variation of this, known as *histeri*, or hysteria, also occurs. A characteristic of a woman with *histeri* is that she develops a sort of nymphomania characterized by uninhibited

aggressive sexual remarks and behavior toward men.

Childbirth.—Childbirth always takes place at home and in private. Even the midwife may not be present until after the child has been born unless it is a difficult delivery. In mountain hamlets, most of the women have their children quite alone. It is the custom that a woman should not cry out at childbirth "or people will laugh." As one woman put it, they would say "you were quiet when the nice things happened, but cry now."[10]

The old local posture for childbirth seems to have been sitting or squatting, holding on to something for support. The midwife today, however, recommends that mothers lie down.

It is always a midwife, not a doctor, who is called in at the time of a birth. She puts drops of silver nitrate in the eyes of the baby at birth and gives the mother advice on caring for the new-born infant. While infant mortality during the first year is less than in former years, it is still fairly high. Deaths in childbirth and stillbirths also occur occasionally. A stillbirth is as likely as not to go unrecorded in the village office records.

The afterbirth is buried somewhere in the house yard, and the father then steps over it. There is a belief that the father should do this because the child will fear the person who first steps over the afterbirth, and it would, of course, be very undesirable for a dog or some other animal to do this. The umbilical cord is usually saved and tucked away in the rafters—according to some, so that the baby will learn well; according to others, as a means of protecting its health. Ultimately it seems to be consumed by mice.

The mother is usually up on the third day, when there is a special naming ceremony for the infant. She is not supposed to do heavy farm work until about a month after the birth, when there is another special ceremony. However, she is up and around the house and yard, frequently doing rather heavy work, thus contributing to the heavy strain to her system. Such practices may be a cause of much of the older (35 and over) women's illnesses in the village. If she did not do her share of housework after the thirtieth day, she would be subject to the criticism of other women for being lazy and self-indulgent. When the 30-day period is over, even though she may not be well enough for field work, local custom and public opinion exert such strong sanctions that she must do her share of farm labor.

It is a peculiar fact that there appears to be no menstruation for about a year or more after a birth among the village women, although there may be a rather long flow immediately following childbirth. This phenomenon appears to be characteristic especially of the farm women and may be associated with the fact that they are up and working in the fields before their system has regained its normal postnatal functioning.

Abortions are rare, and there was only one case in Suye by a woman of a non-village family who was regarded by the people of Suye as crazy.

Circumcision occurs frequently but is by no means general. The operation is performed around the age of 17 or 18.

MISCELLANEOUS MINOR AILMENTS AND HOME REMEDIES

Minor ailments of various sorts are legion, as are also the remedies therefor.

Fish poisoning occurs. For toothache and headache, which are common, *beni* is frequently applied. There is a *Jizō-san*[11] stone regarded as good for toothache and another one regarded as good for earache in the Mura. Boils are common and may be cut by a doctor or treated with some special medicine. Sore throat occurs occasionally. Two cases of bad eyes were treated by doctors in Menda and Hitoyoshi, but the exact troubles were not ascertained. I once saw an old woman with something in her eye and a younger woman naked from the waist up (it was in July) rubbing the affected eye with a damp towel after which

[10] This taboo on crying out at childbirth is characteristic of a number of tribes in northeast Asia, such as the Chukchee, and perhaps dates back to a very early period of Japanese history.

[11] A popular protective and beneficent deity of Buddhist origin.

she squeezed some milk into it from her breast.

There was one mention of neck-gland trouble. The patient first tried a doctor then tried a remedy called *buri* and moxa, and finally he went to a hotspring. There are some plant allergies, one case of rash being attributed to contact with the *haze* plant (wax tree). There was one case of a large head cyst (?), which was cut out three separate times. The last operation was performed at Taragi Hospital and cost ¥8.50. One man had a kind of sleeping illness. He would work a few days and then sink into a sort of coma for a period of days. He was said to have fallen when at work five years before. There was one case of a man with swollen testicles. There was one case of a woman with a violent headache and swelling of the head, neck, ears, and face. She also had fever. She had a pain in the heart as the head throbbed and "blood rose." No doctor was called; instead she went to see a *kitōshi*. There was one case of a woman (teacher of the flower arrangement class) who was taking special shots during menopause. They were supposed to renew menstruation and rejuvenate. The woman said these were made of horse urine (hormones?).

Warts may be removed by surgery. There is a belief that a wart at the corner of the eye of a woman means that she will lose her husband early. If it is under the left eye, one will lose a girl child; if under the right eye, a boy child.

Some home remedies include the following:

Various herbal remedies are common. The herbs may be purchased from dealers in towns or from itinerants and are usually boiled up into some infusion which is taken internally. *Tōfu* liquid is said to be good for the heart and is drunk by some. Fresh-water snails (*binna*) from paddies are said to be good for swellings and muscle strains. *Yamagobō* is a root boiled in water said to be good for the cure of kidney diseases. It induces urine and is also used to cure syphilis. Pumpkin taken in January is a preventive against paralysis and sickness for the coming year. Juice in which plums are pickled is good for the stomach. The white of egg mixed with *mugi*[12] is said to be good for boils. *Mugi* relieves the fever and the egg takes out the pus. (One man makes this and gives it to friends.)

Milk is regarded as a medicine and is taken (boiled) on doctor's prescription. The people do not like it—"It smells."

One man with a blister on his leg took a needle with a heavy thread and dipped it in a pool of water, then rubbed it against some soot on a pot, stuck the needle through the blister, thus letting out the water and leaving a black smudge. There is perhaps a sort of logic to his actions. Antiseptic is liquid—water is liquid and used for washing, hence dipping the needle in water. A flame is used to purify a needle, leaving soot on the needle, hence the application of the needle to the soot of the pot.

MEDICINE AND DOCTORS VERSUS HEALING PRIESTS

Faith is put in home remedies and healing priests partly because doctors are expensive and difficult to get and often are supercilious in their treatment of rural patients. A good example of an individual farmer's appeal to both doctor and *kitōshi* is seen in the following case:

> The other day Muchan (farmer T's small girl child, aged 3) got very sick. She must have eaten something. In the morning the mother gave her an enema, later they sent for a doctor. Dr. K of Fukada was too busy (someone saw his car here, but the story is he had to go somewhere else). Dr. F from Taragi was called and arrived at six as against three, as promised. He had to attend a soldier's going away party. Dirty and sloppy when he arrived. Wore military boots and cape. Talked in an arrogant tone to farmers, "Who is coming with me to fetch medicine?" "Oh, you are —then take this" handing over his brief case. He decided the baby was all right—poured down her throat a bottle of castor oil then told them to fill the bottle with water and made her drink that (boiling the water he never mentioned). Everyone around marvelled "what, taking oil without sugar!"
>
> Prescribed two medicines—a powder and a mixture and left. He did take her temperature. Did not wash hands before seeing the patient, but demanded water after. While he was there, Mr. M came with a pain in his rump and asked for an injection. The doctor picked out a likely needle

[12] A generic term for barley, wheat, oats, and rye.

and dipped it in ether, but to open the glass capsule he used his dirty scarf. The man stretched out and got the injection.

By nine Muchan's temperature went to 104. Ice packs were on her head. The baby drank water constantly. Mrs. K (a neighbor) came and told the people they should go "kami sama mairi"[13] and I think referred to Kannon sama, but Kyoko san (the mother) went upstairs. (Later Mrs. K who loves to make fun was relating the story to some neighbors—how they urged each other to go and pray and had not thought of it at first. "People never think of doing it until the person is dead".)

When the child started having convulsions, they sent their nit-wit assistant to Yunoharu to call the "Yonoharu oji san" who came later. He is deaf and toothless. He has an *ofuda*[14] which he has used for the last 40 years. He mutters incantations and puts the *ofuda* on the patient's chest—then "something leaves the body" and the patient is relieved. The man came at ten and administered a prayer, was to give another one three hours later, but the baby had more convulsions at twelve, so he was urged to pray. T had great faith in him, and each time the baby shuddered in her sleep he would say "Ji san what is it?" and the old man would say "that is all right." They felt the child was better after the treatment. They were afraid because their first child had died. After the second fit at twelve the child quieted down and toward morning was better. When I came at seven they were having rice and beans for breakfast. The Yunoharu man and the old man from Tontokoro stayed all night. S was there until late. Mrs. K and Mrs. S were the only women who called. No one seems to know what sort of a sect the old man belongs to. "Donna kami sama desho?" they say. By next day the child was all right.

Sickness is a constant hazard in a villager's life. It is something that is unpredictable and dangerous in addition to the pain and suffering involved. There is also an economic loss suffered. People the world over, when faced with something they do not understand and something that can affect their lives seriously, turn to supernatural means in an effort to gain some control over it. Hence, the appeal of T to a healing priest in an effort to gain some control over the illness of his daughter.

MEDICINE AND MAGIC

Many of the medicines and home remedies used in the village are, by modern medical standards, simply so much magic. However, there is a logic behind them, much the same logic we use in taking vitamin pills and other medicine on the recommendation of the doctor. We have no way of telling whether what we are being told to take is good for us but must depend upon the word of the doctor or druggist, just as the Japanese peasant depends upon the word of the doctor or druggist or *kitōshi*. Many of the home remedies and other cures are perfectly logical attempts to cure the sickness, the error being in the false premises as to the cause of the disease. If one believes that a sickness is due to black magic or witchcraft, then it is perfectly logical to visit a *kitōshi* and ask for some countermagic to overcome the illness. If it is believed that a certain illness is due to bad blood, then a medicine said to purify the blood or clean out the system is a perfectly logical remedy. The general idea of bacteria as a cause of disease is pretty well lacking in the villagers' concept of disease, just as it was lacking in Europe in the highest medical circles prior to the birth of bacteriology.

The beliefs in regard to sickness and health can, however, be shifted from the traditional folkways to those of modern medicine as evidenced by the naïve faith in doctors, "injections," and in the general acceptance of such governmental health regulations as smallpox vaccination and house-cleaning inspections.

ATTITUDES TOWARD ILLNESS

The proper attitude for a Japanese to take regarding illness in talking with a stranger is to belittle it so as not to burden a guest with his personal worries and anxieties. However, within the family and among friends, grief may be shown. Among rural people the inhibitions are fewer in this regard, and relatives may show their anxiety more freely than among the more inhibited upper classes.

Sometimes in an effort to console themselves, people will resort to a sort of fatalism, laying their misfortunes to decisions made in heaven or by the gods (*kamisama*).

[13] To visit and pray to deities.
[14] Paper talisman.

TABLE 1.—LIST OF DEATHS OVER ONE YEAR PERIOD (1935)
(Population of Mura 1,663 persons)

Sex	Age	Cause of Death	Day of Death
Male.....	72	Cold (*kambō*)	January 15
Female.....	1 day	Unnatural death (*henshi*) (actually this was a case of infanticide)	February 5
Male.....	77	Uremia (*Nyōdokushō*)	March 16
Female.....	69	Cerebral hemorrhage (*Nōshukketsu*)	March 21
Male.....	56	Apoplexy (*Nōikketsu*)	March 31
Female.....	23	Pulmonary tuberculosis (*Haikekkaku*)	April 1
Male.....	67	Apoplexy (*Nōikketsu*)	April 20
Male.....	60	Apoplexy (*Nōikketsu*)	April 29
Female.....	11 days	Pneumonia (*Haien*)	May 31
Male.....	67	Cerebral hemorrhage (*Nōshukketsu*)	June 4
Male.....	64	Incomplete closing of mitral valve (*Sōbōbenfuzenhei*)	July 15
Female.....	5 days	Premature birth	July 17
Male.....	58	Apoplexy (*Nōikketsu*)	August 9
Female.....	49 days	Heart convulsion (*Shinzōkeiren*)	August 20
Female.....	22	Pneumonia (*Haien*)	August 26
Male.....	66	Apoplexy (*Nōikketsu*)	August 29
Male.....	62	Appendicitis (*Mōchōen*)	September 6
Female.....	6	Acute brain fever (*Kyūsei nōmakuen*)	September 6
Male.....	65	Cerebral hemorrhage (*Nōshukketsu*)	September 15
Female.....	2	Acute gastroenteritis (*Kyūsei ichōkataru*)	September 16
Female.....	68	Asthma (*Zensoku*)	September 17
Female.....	1	Pneumonia (*Haien*)	October 10
Female.....	70	Cerebral hemorrhage (*Nōshukketsu*)	November 10
Male.....	4 mos.	Pneumonia (*Haien*)	November 13
Female.....	54	Apoplexy (*Nōikketsu*)	December 4
Female.....	71	Chronic nephritis (*Mansei jinzōen*)	December 27
Female.....	51	Apoplexy (*Nōikketsu*)	December 30

LINGUISTICS.—*A new method of transliterating Russian.*[1] JOHN P. HARRINGTON, Bureau of American Ethnology.

Systems of writing Russian in the letters of the Latin alphabet have been noningenious and without exception very much bound to earlier usage. There are several such systems, each one of them standard within a certain horizon, all of them reaching to specials and to diacriticals. Almost every book for learning Russian has a different method of transcription. The usual systems go beyond the mere turning of the letters of the Russian alphabet into equivalents; they write the variants that characterize the pronunciation of Russian and that more practically remain unwritten with a coverage of general pronunciational rules. The fundamental fault with the average system of transliterating Russian is that it follows the Polish manner of writing, evaluating y as a vowel and thus losing it as a consonant. English, French, Spanish, and Hungarian employ y as a consonant.

The system about to be presented hinges upon the employment of y as a consonant, and with this employment all other equivalences are made to fall into line. The system has in it vast possibilities, not only for the practical transliterating of proper names, but for the romanization of the Russian language and the doing away with the present Greek-based alphabet, thus following the course already taken by Maltese Arabic, Rumanian, Turkish, and Kurdish. The new method is so simple that it can be set in any printing office or punched out on any typewriter, for it uses no special characters of diacritical marks whatsoever yet is adequate to the sharpest scrutiny of the expert phonetician. The system was long and thoroughly actually used in writing

[1] Received February 19, 1944.

field notes in Russian and was found to be quicker and simpler than the use of the Russian alphabet for one accustomed to the Latin alphabetic character of western Europe. That in the eventual future a Greek-based would supplant the actually scientifically superior Latin-based alphabet of western Europe is unthinkable. It is also unthinkable that in the eventual future there would be two different and rival alphabets.

The method is based on the three fundamental principles:

1. Any system to be practical must be based on the so-called Cyrillic alphabet in which the Russian language is at present standardly written; in other words, the system must be a transliteration.

2. Any system to be practical in an ordinarily equipped printing office and on an ordinary typewriter must be without specials and diacriticals.

3. Any system to be practical must be anchored to the conservative values of letters and must possess rigid conformity within itself.

Carrying out of the first principle means that the well-known inconsistencies in Russian orthography have to be followed in transliteration. Thus we have shity, to sew, despite the actual pronunciation shjty; zhity, to live, despite the actual pronunciation zhjty. Both i and j occur after ts, though the pronunciation is always j. Thus tsirk, circus, though pronounced tsjrk.

The new system is better than the Russian, alias Cyrillic, system, in that it has fewer strokes, it is easier to read, and does not require the learning of, or special equipment for, an alphabet which is not Latin. The Russian alphabet in its printed and typewritten form is noted for the lack of ascenders and descenders, the letters having compact, rectangular shape, optically disadvantageous according to tests of psychology. For instance, the Russian form of l is disadvantageous in not shooting above the body line, as it is called in the printing trade. The Russian letters, most of them, resemble monotonous blocks which demand scrutiny, having the form of Latin small capitals, whereas Latin type has ascending and descending offshoots which serve as eye-catching signals of identification, being in this feature psychologically superior to a larger face of type.

Native newspapers and vast literature in languages of South Africa, which have no unusual letters or marks, gave the hint that Russian also can be thus written and printed in Latin letters, it being necessary only to clear the ground by boldly doing away with the Polish value of y, a value that has long lurked to prevent advancement.

It would seem that the system for Russian here suggested cannot be opposed on just grounds, since it consists merely of a making more scientific, simple, regular, and legible the present Greek-based system. It is hoped that it can be used not only for the romanized appearing of Russian geographical names, and the like, but also for the endemic writing of Russian.

THE NEW SYSTEM

Vowels

a o u e i j

The vowels are short only, but an accented vowel can be pronounced long. There are no true diphthongs, all diphthongs being of the sort exemplified by aw ay.

Consonants

Dorsal: k g ç
Retromedial: y
Frontal: t d sh ch zh s ts z r l n
Labial: p b f v m

Consonants are iotized before e or i of the same word, and this iotization is a blanket rule and is therefore not written in the system. Otherwise iotization is written by postplaced y. Etymofinal voiced consonants are unvoiced in pause, just as in German, not being voiced as they are in modern Scandinavian or in English.

For illustrating the new system one cannot do better than to give lines of poetry, since the iambic beat in the following shows the fall of the unwritten accent. Prosaic accent in the following poem is violated only by the word mirj, universes, which in prose would have the accent on the first syllable:

Ya	*v*	*etot*	*mir*	*prishol*	*chtob*	*videty*	*sontse*
I	into	this	world	came	in order	to see	the sun

I	*sinjy*	*krugozor,*	
And	the blue	horizon,	

Ya	*v*	*etot*	*mir*	*prishol*	*chtob*	*videty*	*sontse*
I	into	this	world	came	in order	to see	the sun

I	*vjsi*	*gor.*
And	the heights	of mountains.

Ya	*v*	*etot*	*mir*	*prishol*	*chtob*	*videty*	*more*
I	into	this	world	came	in order	to see	the sea

I	*slavnjy*	*tsvet*	*dolin—*	
And	the glorious	color	of the valleys—	

Ya	*zaklyuchil*	*mirj*	*v*	*yedinom*	*vzore.*
I	embraced	the universes	in	one	glance.

Ya	*vlastelin.*
I	the master.

Ya	*pobedil*	*çolodnoye*	*zabveniye*		
I	conquered	cold	oblivion		

	Sozdav	*mechtu*	*moyu,*	
	Having created	fancy	my,	

I	*kazhdjy*	*mnig*	*bjl*	*polen*	*otkrjteniya.*
And	every	moment	was	full	of revelation.

Vsegda	*poyu.*
Continually	I sing.

GEOCHEMISTRY.—*The formation of colloid from halloysite in dilute acid solutions.*[1] P. G. NUTTING, U. S. Geological Survey.

Intensive soil research of the past few decades has clearly shown the presence in most soils of complex mineral aggregates of siliceous colloids. These aggregates may be either massive, in a filterable clear solution, or coatings on microscopic grains; they may be sol, hydrosol, gel, or solid. They form definite associations with the ions of a solution as reported by Sante Mattson and others in numerous papers in Soil Science. The writer[2,3,4,5] has reported a number of studies of relations between dilute acids and clays of the montmorillonite type. Abundant evidence was found for the formation of considerable quantities of stable colloidal hydrosols as well as of salts in dilute acid solutions. To obtain exact quantitative relations between the amount of sol formed and the amounts of acid, clay, and water present, work was continued with the simpler clay minerals kaolinite, halloysite, and allophane under carefully controlled conditions. The allophane available (from Hillsboro, Ohio) reached equilibrium in a few hours but contained 3.5 percent CaO and some iron. The kaolinite, from Bishop, Calif., was very pure but required five days at 96° C. to approach equilibrium.

The halloysite used, from Anamosa, Iowa, contained no detectable Ca, Fe, or Mg. It was room dried and ground to pass a 150-mesh sieve (0.1 mm). As used it contained SiO_2 42.45, Al_2O_3 36.02, H_2O 21.53, or

[1] Received January 11, 1944.

[2] *The action of some aqueous solutions on clays of the montmorillonite group.* U. S. Geol. Surv. Prof. Paper 197-F. 1943.

[3] *Time and temperature effects in the formation of colloidal dispersions.* Journ. Washington Acad. Sci. 31: 41–45. Feb. 15, 1941.

[4] *A study of the association of magnesia with silica in a pure magnesium clay.* Journ. Washington Acad. Sci. 30: 233–237. June 15, 1940.

[5] *A study of bleach clay solubility.* Journ. Franklin Inst. 224: 339–362. Sept. 1937.

$Al_2O_3 \cdot 2SiO_2 \cdot 3.4H_2O$. The alumina was completely soluble in a few hours in 20 percent acid. Special tests showed that 72 hours at 96° in 0.1 percent acid gave a close approach to equilibrium, while at 30° six months would have been required[6] for each run. The relations between the amount of sol and the amounts of clay, acid, and water are, of course, very different at the two temperatures, but apparently only the constants of the reaction equation are affected.

Preliminary runs showed that the center of interest is sufficient acid to dissolve the alumina (0.75 gram HCl per gram of halloysite) in sufficient water to dissolve the silica (1 liter per gram of clay), or a gram of clay in a liter of 0.075 percent HCl. Preparations were made with ½, 1, and 2 times these amounts of clay, acid, and water, 27 in all (or 19 excluding simple multiples) which were analyzed.

After 72 hours at 96°±1°, the last 16 hours without stirring, the clear liquor was decanted with an aspirator flask and the undissolved clay filtered, washed, ignited and weighed. A few ml of the decanted liquor was cooled for *p*H determinations. Each solution was evaporated and the residue, heated to 160° for an hour to remove free acid and moisture without disturbing OH, and then weighed. Each residue was then boiled 10 minutes in 150 ml of distilled water to remove possible chlorides, again dried at 160° and weighed. Silica and alumina were then separated by a ten minute digestion in about 20 ml of hot 20 percent HCl. Repeated runs gave results duplicating within 2 percent.

Undissolved clay residues varied between 22.9 percent for clay:acid:water = ½:1:½ to 91.7 percent for 2:½:2. In composition, they differed but little from the original halloysite. The *p*H of the solutions varied chiefly with the clay:acid ratio, 2.5 for original clay:acid = 2:1 to *p*H 1.5 for clay:acid = 1:2. It varies little with the water present, by about 0.02 for half or double the amount of water; hence both the dissociation and hydrolysis of reaction products are but little affected by the amount of water present in this range.

Residues from evaporation of solutions varied from 0.125 to 0.709 gram per gram of clay, the chief factor being the ratio of acid to clay. In each of the nine sets of observations in which the clay:acid ratio was constant, the amount of residue decreased by one-third as the water alone varied from ½ to 2 liters.

The hot-water extract of the solution residue (150 ml) always caused a loss in weight averaging 20 percent, both weighings following thorough drying at 160°. This extract was neutral to litmus and added ammonia gave no precipitate except in two cases of high acid:clay ratio, hence was free from acid and aluminum chloride. Analysis showed it to be an alumino-silicate hydrosol with an alumina:silica ratio of about 1:1.5 (molar). The solution residue not dissolved by 150 ml of hot water varied from 0.056 to 0.734 gram per gram of original clay as acid varied from ¼ to 4 normal ("normal" is 0.75 gram HCl). With clay:acid 1:1, it decreased from 0.375 with water ¼ to 0.151 gram for water = 4 liters per gram. An average of the 19 analyses (27 combinations) gave $SiO_2:Al_2O_3 = 0.88$, close to that for $2Al_2O_3 \cdot 3SiO_2$ (0.884). This ratio varies slightly with the ratio of acid to clay; extremes were 1.1 for acid:clay = 4 and 0.7 for acid:clay = 1:4. The average composition of the washed residue at 160° is SiO_2 34.8, Al_2O_3 40.0, H_2O 25.2 percent or very close to $2Al_2O_3 \cdot 3SiO_2 \cdot 7H_2O$, an allophane. Similar runs but less extensive and less exact, made with kaolinite, mica, and allophane instead of halloysite, gave the same allophane hydrosol.

The amount of sol (S) produced, time 72 hours and temperature 96° being constant, depends upon the three independent variables clay (C), acid (A), and water (W). Mere inspection of the 19 analyses yields only the qualitative summary given above. To obtain exact reaction equations between sol, clay, acid, and water, the 27 analyses were plotted in various sets of graphs. In each set, one factor (say clay = 1 gram) is constant throughout, another (say water) is the parameter, constant in each group while the third is the chief variable, the object being to discover linear relationships, if any, between these variables. Three such relations were found:

[6] *Op. cit.*, footnote 3.

Sol: Acid, clay, and water constant, acid variable.
Log (S:A) linear in log C, water constant.
Log (S:A) linear in log W, clay constant.

These three relations may be combined in

$$\text{Log } S = \log A + a \log C + b \log W + \text{const.}$$

With this as a guide the 27 analyses were written as 27 equations which were solved by least square methods to obtain values of the constants. Using natural logarithms the final relation is

$$\text{Log } S = \log A + 0.322 \log C - 0.318 \log W - 1.421$$

for grams of sol formed where pure halloysite is brought to equilibrum with dilute hydrochloric acid solutions at 96°. This relation holds for acid:clay ratios below 1:4 (by weight) up to about 4:1 above which free chlorides are formed. All constants depend upon temperature. The clay is in grams, the water in liters, and the acid in multiples of 0.75 gram. For $C=1=W$, $S=0.24$ A, or $75\,S=A$ in molar proportions, if the molecular weight of the sol is 510, indicating that the acid is used many times over. Water and clay are evidently in competition for the acid.

The chemical processes involved appear to be very simple. After the clay has adsorbed sufficient anions it is attacked by them. Free silica and chlorides go into solution and the chlorides are hydrolyzed, alumina combining with the silica to form a sol while the free acid returns to the clay to form more chloride. This process continues until the potential of the accumulated sol is balanced by that of the clay. This balance is at somewhat less than half the clay because the halloysite has some structural energy while the sol has little or none.

SUMMARY

Halloysite in warm dilute acid forms a sol having the composition of allophane $2Al_2O_3 \cdot 3SiO_2 \cdot 7H_2O$ after drying at 160° C., over an intermediate range of clay and acid concentrations.

A quantitative relation between sol formed and the acid, clay, and water used is obtained from experimental data covering the range from just sufficient acid to dissolve the alumina and water to dissolve the silica, to half and double these amounts.

At equilibrium, the clay solution contains free acid (pH 1.5 to 2.5) but no salt other than the sol in this range.

With clay and water as parameters, the amount of sol formed is in a fixed ratio to the acid present.

With acid and water as parameters, the sol varies with about the cube root of the clay present, indicating a reversible reaction.

The amount of sol varies inversely with the water present, clay and water competing for the acid present.

After oven drying at 160°, the sol (then gel) is soluble in hot water to the extent of about 0.3 gram per liter, slightly less than than silica gel, 0.4 gram per liter.

A general characteristic relation is deduced between amount of colloid formed and the amount of acid, clay, and water present. In reference 3, p. 45, it was shown that silica, alumina, acid, fluorides, and other salts added to the sol solution were without effect on the colloid formed. Variations with temperature and the nature of the acid remain to be investigated.

ECOLOGY.—*An analysis of the flora of the Bull Run Mountain region of Virginia using Raunkiaer's "life-form" method.*[1] H. A. ALLARD, Bureau of Plant Industry, Soils, and Agricultural Engineering.

INTRODUCTION

Ecologists have long been aware of the intimate relations between plant life and climate and, rightly regarding vegetation as an expression of the climatic complex, have attempted to devise methods to express this concretely and statistically in terms of plant life itself. Long ago Humboldt (*Physiognomik der Gewächse*, 1806) attempted to classify vegetation on something of an ecological basis. Griesbach (1872) and others building upon these concepts recognized

[1] Received November 6, 1943.

the intimate relation between the forms of plants and climate. Among these were Kerner (1863), Warming (1909), and Drude (1913). Such classifications as were recommended ignored taxonomic relationships since it is obvious that the ecological relations of plant life do not depend upon taxonomic concepts. Finally in 1908, a Dane, C. Raunkiaer, published a fundamental paper on life-forms and statistical methods.

Raunkiaer's method was unique in that it considered the plant to be a concrete, living expression not of one factor alone, but of the entire climatic complex, including temperature, humidity, and the water relations of the soil. The basis of his method, naturally, was the final adaptation of the plant, and the special feature selected by him related to the critical or unfavorable season, as indicted by the degree and kind of protection which enabled the plants to survive this in a particular region. This, it is obvious, was concerned mainly with the perennating buds, formed above or below ground in the case of perennials. While this concept does not afford a perfect measure of climate it has appealed to many plant ecologists as one of the best systems yet devised, since the plant itself has been chosen to represent its own success and survival in a given region.

LIFE-FORM SYSTEM OF RAUNKIAER

Raunkiaer in 1908 finally carefully selected and classified 400 representative plants from the world's flora, and used these to establish a provisional biological spectrum for the world, which he considered to be a standard for comparison. In 1916 he extended his studies to include the remaining 600 species, which he had originally chosen to represent his normal world spectrum. While there were only minor differences in the calculations for the two groups, Raunkiaer's spectrum based upon his final figures for 1,000 selected plants has been used in the present discussion.

His method requires a classification of all the Spermatophyta of a regional flora into five main groups, some of which are subdivided into smaller groups. These are listed as follows, with abbreviations:

PHANEROPHYTES—Ph.—Branching woody plants, with their dormant buds wholly exposed to the air. These are further classified according to size into the following subgroups: (1) megaphanerophytes—Mg.—having a stature over 30 meters (98 feet); (2) mesophanerophytes—Ms.—with a stature of 8–30 meters (26 to 98 feet); (3) microphanerophytes—M.—2–8 meters tall (6–26 feet); nanerophytes—N.—under 2 meters tall (6½ feet).

CHAMAEPHYTES—Ch.—Plants with their dormant buds on the surface of the ground or just above it, not more than 25 cm. (10 inches). These are protected by snows in winter in colder regions, or by the plant remains in dry or warmer regions.

HEMICRYPTOPHYTES—H.—Plants with their buds in the upper layer of the soil, near the surface, the aerial portions dying away in the unfavorable season further protecting these subterranean buds.

CRYPTOPHYTES.—Plants with their dormant structures entirely buried more or less deeply below the soil surface. This class has been subdivided as follows: Geophytes—G.—with bulbs tubers, rhizomes deep below the soil surface; Helophytes—Hl.—certain marsh plants growing chiefly in saturated soil or in water, from which the flower-bearing shoots emerge. Their buds are buried at the bottom of the water or in the muddy soil.

HYDROPHYTES—Hy.—Water plants with their perennating structures beneath the water.

THEROPHYTES—Th.—Annuals living only for the season.

Classification of plants into these various groups requires a little care, for certain plants may seem to fall rather doubtfully into a given class. As a rule, however, it is not difficult to attain this objective, and a few doubtful cases change the final percentages very little. Some of the Hemicryptophytes and Cryptophytes have been less readily distinguished for this reason. Plants were considered to belong to the former class when their dormant buds were not deeper than 1 inch in the soil.

RELATIVE PROPORTIONS OF WOODY AND HERBACEOUS PLANTS IN DIFFERENT REGIONS

In temperate, humid regions the relative proportion of woody plants and herbs tends to be rather constant, as indicated by the following figures, which have been deter-

mined by Sinnott and Bailey (1914). Unfortunately these figures apply to the Dicotyledoneae alone, however. Inclusion of the Monocotyledoneae would decrease the proportion of woody plants and increase the proportion of herbs materially.

In the northern United States (Britton and Brown) woody plants constitute 22 percent of the Dicotyledoneae, and herbaceous 78 percent; northeastern United States (Gray), woody plants 23 percent, herbaceous 77 percent (Dicotyledoneae); including all Angiosperms in Gray's Manual (4,079 species), the figures become 14 percent woody, 85.9 percent herbaceous; Great Britain (Hooker), woody 11 percent, herbaceous 89 percent; Russian Empire (Ledebour), woody 14 percent, herbaceous 86 percent; France (Cusin and Ansberque), woody 11 percent, herbaceous 89 percent; Norway (Blytt), woody 14 percent, herbaceous 86 percent; Flora Orientalis (Boissier), woody 17 percent, herbaceous 83 percent; Spain (Lázaro é Ibiza) woody 21 percent, herbaceous 79 percent. All the above figures, unless otherwise stated, refer to the Dicotyledoneae alone.

Within the United States Deam (including all Spermatophyta) lists 2,568 species for Indiana, 14.4 percent being woody, 85.5 percent herbaceous. Ennis (1928) for Connecticut lists 1,453 native species, of which 15.06 percent are woody and 84.9 percent herbaceous. In the relatively very small Bull Run area (including all Spermatophyta) 18.2 percent are woody, 81.8 percent herbaceous.

It is well known that the percentage of woody plants, trees and shrubs in humid regions increases as one approaches the warmer tropical latitudes. These relations are clearly shown in the following figures based upon the Dicotyledoneae alone: Florida Keys (Small), 46 percent are woody plants, 54 percent herbaceous; Japan (Matsumura), 43 percent woody, 57 percent herbaceous; Brazil (Mueller), 74 percent woody, 26 percent herbaceous; Amazon Valley only, 88 percent woody, 12 percent herbaceous; Malay Peninsula (King), 83 percent woody, 17 percent herbaceous; Philippines (Merrill), 68 percent woody, 32 percent herbaceous; Dutch East Indies (Koorders), 75 percent woody, 25 percent herbaceous.

Comparisons of these figures especially for the humid, temperate regions favorable to forest indicate the common pattern of the vegetation in its ecological aspects. This is true whether one considers the relatively small Bull Run area, the State of Indiana, large portions of the United States (Gray, etc.), Great Britain, or Italy. If the floristics of the primeval vegetation which formerly existed in all these regions could be known it is probable that even greater uniformity of ecological structure would be established. These uniformities appear to represent fundamental floristic and structural relations of the vegetation for the countries in question. However, if plant life, as it now exists, and as Raunkiaer has assumed, is a dependable, concrete measure of the climatic complex, such fundamental relations should obtain. There are probably greater differences existent in the species composition of the vegetation of the several regional floras mentioned than in the life-forms that make up ecological structure of these.

BIOLOGICAL SPECTRUM OF THE FLORA OF BULL RUN MOUNTAIN

A comparison of the biological spectrum of the Bull Run area with Raunkiaer's normal spectrum is presented in Table 1. The data for the Bull Run area are based mainly upon the list of plants recently reported upon by Allard and Leonard (1943). In this paper 1,010 different plants were recognized, 8 other plants (not yet added in print) being found in 1943, bringing the total to 1,018 plants.

The data of Table 1, all of which refer to the Bull Run area aside from Raunkiaer's spectrum, are of some interest. Some workers have been careful to make use of only the native Spermatophyta in the calculation of a biological spectrum for their region. A comparison of the spectra for all the native and introduced Spermatophyta and for the native Spermatophyta alone reveals striking agreement, however. The data for the native Dicotyledoneae alone also show only slight departure from these values.

TABLE 1.—PERCENTAGE OCCURRENCE OF LIFE-FORMS IN THE NORMAL SPECTRUM OF RAUNKIAER AND THE VEGETATION OF THE BULL RUN REGION

Spectrum	Total flora	Occurrence (percent)									
		Th	Ch	H	G	Mg	Ms	M	N	Hl	Hy
Raunkiaer's normal	1000	13	9	26	4		8[1]	18	15		2[2]
All Spermatophyta, native and introduced	980	17.0	1.4	51.7	9.1	1.8	6.4	5.6	4.4	1.4	.8
All native Spermatophyta	847	15.1	1.6	50.4	9.8	1.8	6.3	5.5	4.7	1.6	.8
All native Dicotyledoneae	616	15.9	2.2	48.3	7.3	2.6	8.7	7.1	6.4	.4	.6
All native Monocotyledoneae	224	13.4	—	62.0	16.9	—	—	1.3	—	4.8	1.3
All introduced Dicotyledoneae	108	32.4	—	50.9	.9	—	5.5	5.5	3.7	1.4	.8
All introduced Monocotyledoneae	25	16.0	—	60.0	24.0	—	—	—	—	—	—
All native Spermatophyta in primitive wooded areas	446	3.3	1.3	52.9	12.1	4.0	10.4	8.0	4.9	1.7	.8
All native Spermatophyta in fields, pastures, or cleared or cultivated areas	402	28.1	1.9	50.0	7.2	—	2.4	3.4	4.4	—	2.2

[1] Mg + Ms.
[2] Hl + Hy.

Comparison with Raunkiaer's normal spectrum reveals certain departures for some classes. Considering all native and introduced Spermatophyta, the greatest departure is shown for the Hemicryptophytes (H), which in the Bull Run flora have been determined to be 51.7 percent as compared with the normal spectrum of 26 percent. Since depth of the dormant buds serves to distinguish the Hemicryptophytes from the terrestrial Cryptophytes (G), one may expect some degree of error to appear here in deciding into which class a certain plant should fall. If, however, a summation of the Hemicryptophytes (H) and Cryptophytes (G) is made (the number of Helophytes (Hl) and Hydrophytes (Hy) is too small to affect the results materially), one obtains 30 percent for the normal spectrum and 60.8 percent for the Bull Run spectrum. These striking differences indicate a climate in the Bull Run area highly favorable to Hemicryptophytes and Cryptophytes, plants that are adapted to withstand a cold, dormant season of considerable severity such as the higher temperate latitudes experience.

The biological spectrum for all introduced Dicotyledoneae of Bull Run Mountain agrees closely with that shown for all the Spermatophyta of the area, except in the proportion of Therophytes (T) representing the annuals. This has increased from 17 percent for the latter to 32.4 percent for the former. Since field conditions offer a more favorable habitat for this class, as most introduced plants cannot compete with the vegetation of forest areas, this relationship is the natural one.

The spectra of all native Spermatophyta found in wooded, primitive areas, and also in fields, pastures, or cleared and cultivated areas has also been presented. The differences shown in some of these groups are of significance. It will be noted that the annuals or Therophytes (T) in the more primitive woodland areas represent only 3 percent of the plants, while in cleared and cultivated areas the figure has become 28.1 percent. Hemicryptophytes (H) and Cryptophytes (G) in the more stabilized woodland make up 65 percent of the flora, and only 57.2 percent in the cleared areas. Since there is a progression from annual to perennial types in the early successional stages, and the climate favors an abundant hemicryptophytic and cryptophytic element, an increase in this class of plants is a natural condition as woodland prevails. The herbaceous element in the woodland areas is 72.1 percent, and 89.4 percent in the cleared areas. This too is a correct reflection of actual differences in the vegetation in the two habitats, since the herbaceous element is predominant in the early stages of succession where the forest has been entirely destroyed. The woody element of the cleared areas is only 10.2 percent, compared with 27.3 percent in the more natural woodland areas. Immediately following abandonment from cultivation, the woody element may be almost entirely lacking, but various weedy trees and a variety of shrubs make their appearance in older fields and pastures

until a closed overstory of trees has captured the area. The statistical differences in the life-forms of the two areas plainly emphasize the pioneer successional nature of the old field assemblage in its trend toward woodland. If the field and pasture areas were selected on the basis of age from time of abandonment, the woody element would be found to increase with corresponding decrease in the herbaceous element until the stability of climax conditions between trees and herbs had been attained.

SIMILARITY IN THE SPECTRUM OF THE FLORA OF BULL RUN MOUNTAIN AND THAT OF SOME OTHER EASTERN AREAS

Summarizing the woody elements as represented by Mg, Ms, M, and N, we have 41 percent for the normal spectrum, 18.2 percent for all Bull Run Spermatophyta, and 15.1 percent for all native Spermatophyta of the Bull Run area. If one considers the average for the Dicotyledoneae as listed in the floras of Gray, and Britton and Brown, for the northern and northeastern United States, Small's southeastern flora, Chapman's southern flora, Coulter for the Rocky Mountains, together with the floras of Great Britain, France, Germany, Switzerland, the Russian Empire, Norway, Spain, Syria and the Orient, the woody element amounts to 17.4 percent, and the herbaceous element 82.6 percent. For the Bull Run region the woody element becomes 18.2 percent and the herbaceous becomes 81.9 percent for all native and introduced Spermatophyta. The woody and herbaceous elements of the native and introduced Dicotyledoneae of the Bull Run Mountain area amount of 24.3 percent and 75.7 percent, respectively. The latter figure for the herbaceous element occurring in the Bull Run Mountain area is much higher than 54 percent which has been taken to represent the herbaceous element for the normal spectrum of the world flora. This figure for the herbaceous element falls below that of any temperate region of North America, Europe, or Asia. It very closely approaches the dicotyledonous herbaceous element of floras found in warm areas; namely, 54 percent for the Florida Keys (Small), 57 percent for Japan (Matsumura), and 54 percent for the Upper Gangetic Plain (Duthie), where the phanerophytic or woody component is bigh. The high herbaceous element occurring in the Bull Run Mountain area indicates a regime of north temperate climate considerably removed from that of warm, humid latitudes.

Taylor (1915) (1918) determined the growth forms for the vegetation of New York City and vicinity, and the total flora of Long Island, N. Y., on the basis of Raunkiaer's concepts. Ennis (1928) did a similar and very excellent piece of work for Connecticut. This work is of particular interest when compared with the percentage composition of the growth forms of all Spermatophyta of the Bull Run area, owing to the close agreement in the two areas as shown by the data in Table 2.

TABLE 2.—PERCENTAGE OCCURRENCE OF LIFE-FORMS IN THE SPERMATOPHYTA FLORA OF THE VICINITY OF NEW YORK CITY; OF LONG ISLAND, N. Y.; CONNECTICUT; THE BULL RUN AREA; INDIANA; AND THE NORTHERN AND EASTERN UNITED STATES (Gray)

Spectrum	Total flora	Occurrence (percent)								
		Th	Ch	H	G	Mg	Ms	M	N	Hl+Hy
Vicinity of New York City (native flora)	1907	13.0	5.29	33.29	20.23	.52	4.03	7.18	3.51	11.74
Long Island	710	13.94	5.89	33.15	20.1	.89	4.37	6.34	2.77	10.9
Connecticut (native)	1453	11.7	1.9	49.4	13.2	1.5	3.9	5.8	3.7	8.5
Bull Run region	980	17.0	1.4	51.7	9.1	1.8	6.4	5.6	4.4	2.2
Indiana (Deam)	2420	11.2	1.4	50.9	11.6	1.5	5.08	4.5	3.1	5.7
Gray's Manual (N. & E. U.S.)	4283	15.2	1.4	52.4	10.4	.9	4.1	4.6	4.9	5.6

Total Hemicryptophytes and Cryptophytes (H, G, Hl, Hy). New York City 65.36 percent; Long Island 64.5 percent; Connecticut 71.1 percent; Bull Run 62.0 percent; Indiana 68.4 percent; northern and eastern U. S. (Gray) 68.5 percent.

Woody plants (Mg, Ms, M, N). New York City 15.24 percent; Long Island 14.37 percent; Connecticut 14.9 percent; Bull Run 18.2 percent; Indiana 14.7 percent; northern and eastern U. S. (Gray) 14.7 percent.

Herbaceous plants (Th, Ch, H, G, Hl, Hy). New York City 83.55 percent; Long Island 85.63 percent; Connecticut 84.7 percent; Bull Run 81.8 percent; Indiana 85.3 percent; northern and eastern U. S. (Gray)85.3 percent.

The greatest discrepancies are shown for the Hemicryptophytes (H) and the Cryptophytes (G, Hl, Hy). However, these classes are most readily confused, since little more distinguishes the plants of each than the depth of the dormant buds. It will be noted that the summations, however, give remarkably close total percentages. The summations of all the Phanerophytes or woody plants (Mg, Ms, M, N), and the herbaceous plants (T, Ch, H, G, Hl, Hy) also give very close values. These results indicate that the ecological structure of the vegetation in these four areas is strikingly similar.

PHYSIOGNOMY OF VEGETATION NOT REVEALED BY THE BIOLOGICAL SPECTRUM

Raunkiaer's biological spectrum was devised to serve as a concrete expression of climate in terms of living plants. This has required a reduction of all the climates of the world to an average expression in terms of growth forms, in order that the spectrum would represent a mean concrete expression of the plant life of temperate, cold, and tropical climates. Since very cold and very warm climates have helped to make up this normal spectrum, it must represent some intermediate condition of climatic plant expression so that it can be neither strictly tropical, temperate, nor frigid. It would be exceptional, then, to find a section of our north temperate flora, a frigid or a tropical flora showing exact agreement with this standard spectrum in all respects.

While the Raunkiaer method of analyzing vegetation on the basis of its ecological life-forms may afford a statistical means of evaluating the structure of vegetation of a climatic zone, it does not reveal the physiognomy or visual aspect of such vegetation. It does not indicate whether the dominant vegetation of the climax forest is deciduous, evergreen, coniferous, or broad-leaved evergreen. As Ennis has shown in her discussion of Connecticut spectra, the Coastal Plain areas of the South have the physiognomy, visually, of a coniferous forest due to an overstory of these, but the region is one of deciduous forest in its fundamental trends. In other words, the coniferous aspect is due to other influences than climate, such as determines the great natural coniferous forests of the North, and the higher mountain lands of the Appalachians. These forests at all levels are coniferous in their structure. In the Bull Run area, the deeper, richer soils of the slopes and valleys are given to deciduous forest naturally. The sharp, dry, barren ridge crests carry a permanent thin mantle of several species of pines, which, in some areas noticeably affect the physiognomy of the area.

There is but one broad-leaved evergreen species in the Bull Run area which has any physiognomic significance, and this is confined to the understory entirely. This shrub, *Kalmia latifolia*, completely dominates the understory of extensive areas of the woodland slopes to such an extent that little else can compete with its dense vegetation. In reality this evergreen shrub is the only species normal to the flora of the Bull Run highlands, for *Ilex opaca* and *Phoradendron flavescens* are practically out of their normal range here. Only 10 species of woody evergreen plants occur in this area.

The minor importance of this group in this area compared with the flora of various other areas is shown in Table 3.

TABLE 3.—PERCENT OF WOODY EVERGREEN SPECIES, BROAD-LEAVED EVERGREEN SPECIES, AND EVERGREEN CONIFERS IN THE FLORA. (Data in part from Ennis, 1928.)

Flora	Species of woody plants	Evergreen species		Broad-leaved evergreens		Evergreen conifers	
		No.	Per-cent	No.	Per-cent	No.	Per-cent
Florida.....	357	111	31	98	27.4	13	3.6
District of Columbia....	187	20	10.5	12	6.3	8	4.2
Connecticut...	219	21	10	8	4	13	6
Penobscot Bay.	97	16	16.4	4	4.1	12	12.3
Bull Run region	188	10	1	3	1.5	7	3.7

The data of Table 3 indicate the increased importance of the broad-leaved evergreen plants in Florida, and the minor importance of the evergreen conifers here. This relation is reversed for the Penobscot Bay region where the evergreen conifers become a dominant element of the flora and the broad-leaved evergreens reduced. Although the woody plants of the District of Colum-

bia and the Bull Run area are almost identical in number, with a similar evergreen coniferous content, the broad-leaved evergreens are much more important in the former area.

ADAPTATION OF LIFE-FORMS OF PLANTS IN RELATION TO THE UNFAVORABLE SEASON

While Raunkiaer's classification takes into consideration the adaptation of the various plants to the season most unfavorable to growth, this being the severe winter season in the colder northern latitudes, the relationship is not one of direct cause and effect. As a matter of fact in the case of most of the woody and herbaceous perennials the perennating buds are laid down near midsummer in response to factors of the climate seasonally far removed from the actual cold of wintertime. Whatever these factors may be it is obvious that the plants have been ecologically preconditioned in one way or another to meet the oncoming severe winter conditions at the end of the warm growing season, even though this may have been merely an incidental and not a causal relationship in the life of the plant.

While the factors of humidity, temperature, wind velocity, rainfall, and percentage of sunshine are seasonally extremely variable, one factor, length of day, is an astronomical event recurring with great constancy from year to year. The work of Garner and Allard in 1920 demonstrated that the life-form and life-duration of plants could be profoundly modified by this regular recurring seasonal factor of climate. At the present time the great desideratum in our knowledge of climate in relation to the life-forms of plants is the lack of specific information as to how the climatic complex selectively or adaptively determines the character of the spectrum that will prevail in a particular zone. That there is a fundamental reason why Hemicryptophytes and Cryptophytes are dominant in the flora of the cooler middle latitudes, such as in our humid north temperate zone, cannot be doubted. It cannot be denied that a given flora is adaptively related to a particular climate as Raunkiaer's life-form studies have postulated. Unfortunately, there is little evidence at hand at the present time to explain the mechanism of this seeming adaptiveness. Raunkiaer, as the result of

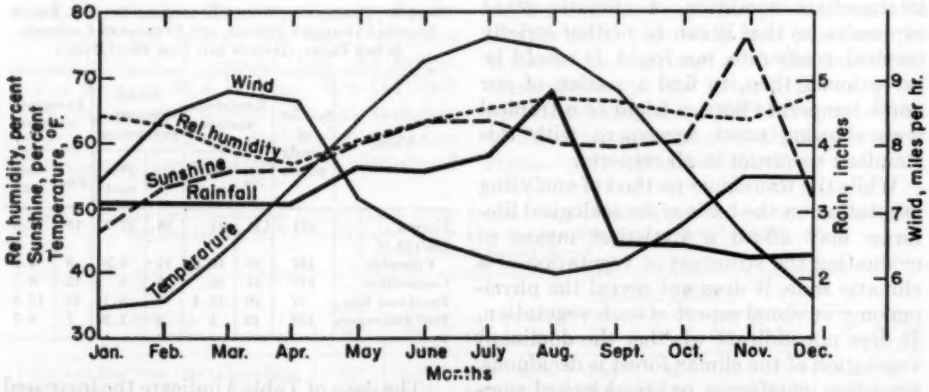

Fig. 1.—Climatic regime for the Bull Run Mountain region, typical of the Hemicryptophyte climate of the Eastern Atlantic States. The normal temperature, humidity, sunshine percentage, wind velocity, and rainfall curves are shown for each month of the year. Rainfall is for nearby Manassas, Va., interpolated for 35 years from about 20 years of records. The temperature curve is the mean of records for Washington, D. C., and Culpeper, Va., which is the nearest weather station recording temperatures. The curves for humidity, wind velocity and sunshine were taken from Washington records. The humidity curve is based upon the mean of the normal minimum and maximum values computed from records of the U. S. Weather Bureau station for 7:30 A. M. and midday, respectively. The figures for temperature also correctly represent the percentages of sunshine and relative humidity.

his fundamental investigations of the life-forms of plants showed that some species can change their characteristic life-form to a greater or less degree. One of these, *Tussilago farfara*, in Denmark is a Cryptophyte, but in milder or more southern latitudes becomes a Hemicryptophyte. This observation has fundamental implications in an interpretation of the dependence and occurrence of life-forms in relation to a particular climate.

CONCLUSIONS

It is obvious that the Bull Run region, like all the eastern portions of the United States, is dominated by a Hemicryptophyte climate. Fig. 1 shows the dominant features of such a climatic regime with respect to normal temperature, relative humidity, rainfall and wind velocity over a long period. Temperature and available moisture are very largely responsible for the general character of the climax forest vegetation of a region. It appears from Fig. 1 that every factor of the climatic complex in our eastern forested region favors the conservation of moisture during the growing season so far as plant life is concerned. As the duration and percentage of sunshine and temperature increase the relative humidity of the air and the rainfall increase, and the mean wind velocity decreases, serving as an additional check upon evaporation at a time when the temperatures are highest. It is thus seen that when the plants are forced into their maximum activity by one set of factors, others operate to counteract any unfavorable tendencies, thus constituting one of the most ideal climates for many types of mesophytic vegetation. This favorable and supplementing interplay of all factors, then, is particularly favorable to a very luxuriant summer vegetation dominated by deciduous forest as the overstory, with a rich Hemicryptophyte flora beneath this forest cover capable of surviving severe conditions, with its enforced dormancy of vegetative activity.

Whatever the significance of Raunkiaer's normal world spectrum, his studies indicate convincingly that the life-forms of plants are so definitely related to a particular climate that the constancy of relationship must be determined or conditioned by the operation of definite climatic laws prevailing under every climatic regime. It must be admitted, also, that his life-form classification, with its statistical aspects, may have genuine ecological meaning in the interpretation of some features of the striking relationships of vegetation everywhere.

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ENTOMOLOGY.—*Concerning Neotropical Tingitidae (Hemiptera).*[1]

C. J. DRAKE and E. J. HAMBLETON, Iowa State College.

This paper contains the descriptions of 2 new genera, 15 new species, and 1 new variety and notes on a number of other species of lace bugs from Neotropical regions. The specimens were collected largely by the junior author. The types are in the Drake collection.

Subfamily CANTACADERINAE

Phatnoma amazonica, n. sp.

Closely allied to *P. marmorata* Champion but readily distinguishable by the nonannulate femora, nearly uniform brownish color, shorter and more ovate form, the apical portion of foliaceous nervure separating discoidal and subcostal areas without a blackened area; costal area also one row of areolae wider; oblique, adventitious nervures of discoidal and subcostal areas much less prominent and not differently colored; head slender. Other characters very similar to *P. marmorata.*

Length, 3.30 mm; width, 1.25 mm.

Type (female), Pará, Brazil.

In *P. marmorata,* the veinlets dividing the areolae of the foliaceous nervures delimiting the discoidal area are infuscate. The entire insect is quite marmorate in general appearance, whereas *amazonica* is almost uniform in color.

Phatnoma marmorata Champion

Known from Panama, Honduras, and Brazil and recorded from the cocoa bean. One specimen from Trinidad, B. W. I., was taken on cultivated pineapple, May 25, 1934, by Dr. A. M. Adamson.

Stenocader, n. gen.

Obovate, more convex above in long- than short-winged form. Head very long, rather broad, tumid above, with two pairs of spines in front of eyes; bucculae long, reticulated, meeting a little before apex of head. Antennae long, slender, smooth; segments I and II short, together not reaching apex of head, the former slightly longer and stouter; III very long, very slender, often longer in male than female; IV rather short, moderately thickened. Rostrum extremely long, extending considerably on base of abdomen; rostral channel distinct, the laminae raised and subparallel, the venter strongly impressed along median line of basal half so as to form a distinct groove for the reception of rostrum. Eyes set close to pronotum.

Pronotum narrowed anteriorly, subtruncate in front, pitted, with five carinae, the outer or lateral pair short, the middle pair interrupted at base of collar, hind margin of pronotum not strongly produced, subtruncate or slightly convex; scutellum small, exposed. Paranota narrow, only slightly reflexed, the outer margin serrate, somewhat toothed. Elytra divided into the usual areas, the discoidal and subcostal areas with raised transverse nervures, the clavus distinct, within meeting in a straight line; elytra more strongly overlapping apically in long- than short-winged form when in repose, much more convex above in short-winged form, the outer margin of costal area granulated or toothed; wings much longer than abdomen in long-winged specimens.

Type of genus, *Piesma tingidoides* Spinola from Chile.

The discoidal area is very long, extending more than three-fourths of the total length of elytra. The males are distinctly slenderer than the females and also have a little longer antennae. *Stenocader* differs from *Nectocader* Drake in not having the elytra very much more widely and abruptly expanded at the base, and the costal area is without a row of large marginal areolae distinctly set off within by a thickened nervure so as to form practically another area. The rostrum is longer in *Nectocader,* and there is no median furrow on base of venter for the rostrum in repose. In the genus *Cantacader* Amyot and Serville, the scutellum is concealed, being covered completely by the hind margin of pronotum.

Stenocader tingidoides (Spinola)

Piesma tingidoides Spinola, *in* Gay, Hist. Chile, Zool. 7: 200. 1852; Signoret, Ann. Soc. Ent. France, 1863: 575.

Cantacader tingidoides Reed, Rev. Chil. Hist. Nat. 4: 179. 1902 (reprint, p. 86).

Cantacader? germaini Signoret, Ann. Soc. Ent. France, 1863: 586; Reed, Rev. Chil. Hist. Nat. 4: 179. 1902 (reprint, p. 86).

Nectocader tingidoides Drake, Iowa State Coll. Journ. Sci. 3: 42. 1928; Rev. Ent. 10: 322.

[1] Received December 23, 1943.

1939; Drake and Poor, Iowa State Journ. Sci. **10**: 383. 1936.
Nectocader germaini Drake, Iowa State Coll. Journ. Sci. **3**: 41. 1928.

Many examples from Chile. The longer antennae of male, and the marked difference between long- and short-winged forms, together with color variations account for the above synonymy.

Genus **Eocader** Drake and Hambleton, 1934

Montea Bruner, 1940.

Haplotype, *Eocader vegrandis* Drake and Hambleton.

In this genus the paranota are uni- or triseriate, the lateral carinae sometimes being distinct or more or less obsolete in specimens of the same species. Only two species are known. The genus *Montea* Bruner is identical with *Eocader*. Long- and short-winged specimens of both species have been examined.

Eocader vegrandis Drake and Hambleton

Eocader vegrandis Drake and Hambleton, Rev. Ent. **4**: 436, fig. 1. 1934.

Originally described from a brachypterous female, Viçosa, Minas Geraes, on the fruit of *Bombax monguba* Mart. Zucc., an imported tree; allotype (male) and several other examples taken on mongubeira, Jardin Botanico, Rio de Janeiro, A. A. Silva. The lateral carinae are often wanting or only faintly indicated in apterous individuals.

In a macropterous specimen the lateral carinae are sharply raised, very distinct and scarcely bent inward in front. The elytra are long, extending considerably beyond apex of abdomen, and overlap at apex; the costal area is triseriate in widest part near base and uniseriate distally. The color of the elytra is testaceous, with the nervures bounding discoidal and the oblique adventitious nervelets of subcostal and discoidal areas dark fuscous. The wings are nearly as long as the elytra. The length is 2.55 mm, the width, 1.20 mm.

Subfamily TINGITINAE

Monanthia berryi Drake

Through an error and misunderstanding of locality label, this insect was wrongly described from Uruguay. The locality label should read, Chanchaqui, Perú, August 21, 1942, P. A. Berry. Since the original description was published, 10 additional specimens have been received from Perú. Not recorded elsewhere.

Teleonemia lanceolata (Walker)

Monanthia lanceolata Walker, Cat. Hemiptera Brit. Mus. **6**: 194. 1873.
Teleonemia albomarginata Champion, Biol. Centr.-Amer. Rhynch. **2**: 43. pl. 3, figs. 18, 18a. 1898.
Teleonemia spectabilis Drake, Ann. Mag. Nat. Hist. (10) **8**: 226. 1931.
Teleonemia dispersa Drake, Ann. Mag. Nat. Hist. (10) **8**: 227. figs. 1, 1a. 1931.
Teleonemia albomarginata Monte, Arq. Inst. Biol. **11**: 298. 1940; Rev. Bras. Biol. **3**: 107. 1943.
Teleonemia lanceolata Drake and Hambleton, Arq. Inst. Biol. **9**: 52. 1938; Drake and Poor, An. Mus. Cien. Nat. **40**: 299. 1942.

As the original descriptions of *Monanthia lanceolata* Walker (1873) and *Teleonemia albomarginata* Champion (1897) agree and the two names apply equally well to the same species, Drake and Hambleton (1938) and Drake and Poor (1942) correctly placed the latter name in synonymy. According to W. E. China, the Walker type of *lanceolata* seems to have been lost and can not be located in the British Museum. The writers have carefully studied very long series of *lanceolata* (Walker) from Brazil, Paraguay, Argentina, Perú, Venezuela, Colombia, several Central American countries, and the West Indies. Specimens vary somewhat in size, color, lateral expansions of paranota and elytra, and the height of median carina. The original description and figure of *albomarginata* by Champion are excellent.

The statements of Monte (1941, 1943) are entirely inept and based upon his opinion rather than a careful study of specimens and original descriptions. His conclusions are entirely erroneous, and the name *albomarginata* Champion will have to be suppressed as a synonym of *lanceolata* (Walker).

Teleonemia quechua Monte

Nine specimens, Satipo, April 12, 1941; 1 specimen, Challanga; 1 specimen, Vilcanoto; 2 examples, Coroico; and 12 specimens, Cañete, Perú, Edson J. Hambleton. One specimen, Villa Vicenzio, Colombia, 1898, O. Burger. In this species there is some variation in color and length of antennae. The antennae are long, moderately stout, and rather densely clothed with very short recumbent hairs; proportions

I:10, II:8, III:115, IV:40. The male tends to be a little smaller than the female. The carinae are sharply raised, thick, foliaceous, the lateral pair being slightly concave within in front.

Teleonemia absimilis, n. sp.

Elongate, broad, fuscous-brown, the paranota, costal and most of subcostal areas, collar, and raised anterior portion of median carina whitish testaceous. Appendages ferrugineous. Hind spines of head adpressed, not reaching anterior margins of eyes, the median and frontal spines short. Rostrum extending to middle of metasternum; rostral channel widening posteriorly, open behind at the middle the laminae testaceous, concave within on metasternum. Body beneath dark ferrugineous, the hind margins of abdominal segments darkened.

Pronotum moderately convex, coarsely pitted, with foliaceous carinae, each uniseriate, the lateral more widely separated and concave within in front, the median elevated in front so as to form a small rooflike hood, subtruncate in front; paranota rather narrow, uniseriate, strongly reflexed slightly wider in front. Elytra slightly widening posteriorly, very slightly constricted beyond middle, together rounded behind when in repose; costal area moderately wide, slightly reflexed along basal portion, the areolae moderately large, hyaline; subcostal area narrow, uniseriate, somewhat testaceous; discoidal area large, narrowed at base and apex, widest a little in front of middle, there six areolae deep, the inner boundary more raised; sutural area large, the veinlets (also of discoidal) only slightly raised, the areolae and veinlets embrowned.

Length, 5.60 mm; width, 1.80 mm.

Type (female), Villa Vicenzio, Colombia, January 1, 1898, Prof. O. Burger, collector.

This species is smooth, somewhat reddish brown, with very pale testaceous margins.The whitish testaceous color of costal area extends to the apex of elytra and is not interrupted behind as in *lanceolata* (Walker).

Teleonemia altilis, n. sp.

Very similar in general appearance and color to *T. molina* Drake but easily distinguished by its smaller size, shorter rostrum, wider costal area and thinner carinae. Rostrum extending a little beyond middle of mesosternum; rostral laminae brownish, thinner and not as widely separated as in *molina*. Head with five rather short, yellowish-brown spines, the three frontal shorter. Carinae uniseriate, the lateral pair slightly concave within in front. Costal area whitish testaceous, uniseriate, the areolae clear, widest opposite apex of discoidal area, there on one side with two extra areolae; subcostal area narrow, uniseriate. Paranota, hood and median carina testaceous. Appendages black-ferrugineous.

Length, 4.70 mm; width, 2.40 mm.

Type (female), Las Juntas, Bolivia. Collected by Steinbach. Separated from *T. prolixa* Stål and varieties by the wider costal area.

Teleonemia inops, n. sp.

Brownish, with some areas infuscate. Head with five spines, the hind pair longer, adpressed, the median and fore pair shorter, directed forward. Antennae ferrugineous-brown, moderately long, shortly pilose; segment III approximately two and one-half times the length of IV; I and II short, the latter smaller. Rostrum reaching near the base of mesosternum; laminae very low, widely separated on metasternum, open behind. Legs fuscous-brown, rather slender. Body beneath dark ferrugineous.

Pronotum dark brown, sharply tricarinate, each carinae uniseriate and with veinlets dividing cells fuscous, the lateral carinae more widely separated, slightly convex within in front; median carina moderately raised in front so as to form a small, rooflike hood, slightly projecting in front; paranota narrow, reflexed, uniseriate, the areolae small. Elytra considerably infuscated, mostly dark brown, the costal area (also paranota, carinae, and collar lighter in color) mostly testaceous; costal area narrow, uniseriate, slightly reflexed along basal portion, the areolae small and clear; subcostal area narrow, uniseriate; discoidal area large, widest near middle, there five areolae deep; sutural and discoidal areas rather widely areolated, the areolae opaque, brown to fuscous, the veinlets not prominent.

Length, 4.55 mm; width, 1.35 mm.

Type (male), La Ceiba, Honduras.

Separated from *T. notata* Champion by the longer antennae, less convex pronotum and wider costal area. It is a little larger than *T. scrupulosa* Stål and the discoidal area is glabrous.

Teleonemia sandersi, n. sp.

Moderately large, mostly dark fuscous, the paranota and costal areas testaceous, some of the transverse veinlets infuscate, the head and pronotum often covered with whitish exudation. Head black, with five stout, moderately long, testaceous spines, the hind pair adpressed, the median directed forward, the front pair curved inward. Rostrum extending to meso- and metasternal suture; laminae thick, testaceous, concave within on meso- and metasternum, more widely separated on metasternum, open behind. Body beneath blackish ferrugineous. Appendages dark ferrugineous, the last antennal segment black. Antennae moderately long, rather densely clothed with short, decumbent hairs; segment I thicker and a little longer than II; III slightly bent, slightly more than twice as long as IV.

Pronotum moderately convex, pitted, sharply tricarinate, each carinae uniseriate, the lateral carinae distinctly diverging anteriorly. Median carina in front and collar raised so as to form a rooflike hood, the anterior margin slightly produced. Paranota narrow, strongly reflexed, testaceous, uniseriate, the areolae moderately large; subcostal area narrow, uniseriate; discoidal area impressed, widest near middle, there five aerolae deep, the areolae rather large; sutural area rather widely reticulated, the areolae becoming larger posteriorly.

Length, 4.78 mm; width, 1.25 mm.

Type (male), Canal Zone, Panama, February 10, 1935, C. H. Richardson; allotype (female), Olhajuela, Canal Zone, February 11, 1921, J. G. Sanders; paratype, Canal Zone, Panama, taken with type.

Named in honor of Prof. J. G. Sanders, who kindly presented us the first example of the species. The sharply raised carinae, raised boundary of discoidal area and raised veinlets of elytra give this insect a striking appearance. The rostral laminae are higher and not so widely separated on metasternum as in *T. altilis;* the pronotum is also more convex and the veinlets of areas of elytra more raised and prominent.

Teleonemia vulsa, n. sp.

Resembling *T. leilei* Drake and Hambleton but with longer antennae, wider costal area, narrower subcostal area and differently colored appendages. Head brown, with five blunt, testaceous spines, the hind pair longer and adpressed. Eyes black. Antennae moderately long, brownish ferrugineous, indistinctly pilose; segment I stouter and longer than II; III long, slightly bent, a little more than three times as long as IV; IV longer than the first two conjoined, blackish.

Pronotum moderately convex, distinctly pitted, brown; paranota narrow, distinct, slightly wider in front, the areolae indistinct; carinae sharply elevated, the areolae distinct; lateral carinae distinctly more widely separated in front, there concave within; median carina and collar raised in front so as to form a rather long, small, rooflike hood, slightly produced in front. Elytra widest near middle, slightly constricted beyond middle, brown, paler along margins; costal area rather narrow, uniseriate, the areolae hyaline and moderately large; subcostal area scarcely wider, biseriate; discoidal area large, narrowed at base and apex, widest a little before middle, there five areolae deep, the areolae rather large; sutural area more widely reticulated, considerably infuscated. Legs dark brown. Rostrum not quite extending to base of mesosternum; laminae testaceous, parallel, more widely separated on metasternum, entirely open behind.

Length, 4.90 mm; width, 1.25 mm.

Type (male), allotype (female), and two paratypes, Chapada, Brazil.

Teleonemia scrupulosa Stål

This species is widely distributed in Mexico, Central America, West Indies, and South America. It has not been recorded from Chile. A number of years ago the species was introduced into the Hawaiian Islands, Fiji, and Australia for the purpose of controlling the weed *Lantana*. The insect has flourished in these countries.

Drake and Frick (Proc. Haw. Ent. Soc. 10: 201. 1939) treat *T. haytiensis* Drake as a variety of *scrupulosa*. This conclusion was based on a study of the type of *haytiensis*, cotype and an extremely long series of specimens of *scrupulosa* from South and Central America, West Indies, Mexico, United States, and islands of the Pacific. The antennal characters seem to warrant the varietal name *haytiensis*. Certain specimens from Texas, which have been ten-

tatively identified as *scrupulosa*, need further study and may perhaps represent another variety or even a distinct species. Monte (Papeis Avulsos Dept. Zool. São Paulo 2: 103. 1942) erroneously treated *haytiensis* as a synonym of *scrupulosa*. His conclusions are not based on an examination of the type or material from the type locality; *scrupulosa* has been much confused in the literature.

Pachycysta diaphana Champion

One example, Surukun, Venezuela, November, 1940, collected by P. Anduzee. Two other examples are at hand from the Amazon region of Brazil. The type locality is "Amazona."

Amblystira pallipes (Stål)

A series of examples, Surukun, Venezuela, November, 1940, taken by P. Anduzee. Many specimens have been studied from Brazil and Colombia. Taken in numbers on Sapindaceae, São Paulo, Brazil, 1934, by Edson J. Hambleton.

Corycera comptula Drake

Five specimens, Campinas, São Paulo, Brazil, April 18, 1937, Edson J. Hambleton. The type locality is Chapada, Matto Grosso.

Corycera juncta, n. sp.

Very much like *C. separata* Drake and Hambleton but separated from it by the longer first antennal segment, testaceous paranota, rostral laminae not so widely separated on metasternum, lateral carinae of pronotum slightly less raised on disc and all carinae are thicker and more elevated on hind triangular process. Head with hind pair of spines brownish, stout, blunt, adpressed, extending as far forward as front margins of eyes; median spine wanting; front pair short, brownish, turned inward. Rostrum extending on base of mesosternum. Costal area moderately broad, whitish testaceous, biseriate in widest part, the areolae clear and moderately large. Legs pale testaceous, the tarsi a little darker. Antennae long, slender, indistinctly hairy; segment I very stout, moderately long, black-fuscous; II short, slender, testaceous; III very long, testaceous; IV slightly thickened, mostly blackish, pale at base.

Length, 2.60 mm; width, 1.05 mm.

Type (female), São Paulo, Brazil, May 22, 1935, E. J. Hambleton.

Amblystira scita, n. sp.

Similar in appearance to *A. socia* Drake but easily separated from it by the slightly more raised lateral carinae and the somewhat rounded and not sharply raised apex of discoidal area. Pronotum black, somewhat shiny, pitted, the lateral carinae slightly divaricating anteriorly. Elytra blackish, the widest or biseriate portion of costal area testaceous, the areolae of sutural area somewhat whitish. Antennae testaceous, most of terminal segment black. Other characters very similar to *A. socia*.

Type (female), and paratype, Mercedes, Costa Rica, August 5, 1928.

In *A. socia*, the apical angle of the discoidal area is sharply raised, acutely angulate, and the hind margin straight; the subcostal area is also wider. Otherwise, except for the lateral carinae, the two species are very similar in appearance.

Atheas placentis Drake and Poor

Five specimens, São Paulo, February 2, 1935, collected by E. J. Hambleton. Reported by Monte as occurring on *Celtis brasiliensis* Gardn.

Atheas laetantis, n. sp.

Head black, without spines. Bucculae testaceous, closed in front. Rostrum brownish, black at apex, extending on mesosternum. Body beneath black. Antennae moderately long, slender; segment I black, slightly stouter and nearly three times as long as II; II short, blackish; III testaceous, slenderest, slightly more than three times as long as IV, indistinctly hairy; IV rather long, almost wholly black, slightly thickened, with longer, pale hairs. Antenniferous tubercles rather long, conelike, nearly straight, becoming testaceous apically. Eyes black. Legs slender, testaceous, the tarsi darkened.

Pronotum moderately convex, pitted, brownish black, sharply tricarinate, each carinae with a row of tiny areolae, the lateral pair parallel; collar distinct, dark brown, testaceous in front. Paranota rather narrow, wider in front, uniseriate opposite humeral angles, biseriate in front, the outer margin nearly straight, the areolae hyaline and moderately large. Elytra with all discoidal and subcostal areas and basal portion of sutural areas fuscous-black, the rest pale testaceous, the areolae hyaline; costal area

rather broad, mostly biseriate, triseriate in widest part, the areolae large, arranged in somewhat irregular rows; subcostal area narrow, mostly biseriate; discoidal area reaching a little beyond middle of elytra, narrowed at base and apex; sutural area mostly widely reticulated.

Length, 2.55 mm; width, 1.10 mm.

Type (male), allotype (female), and 32 paratypes, Viçosa, Minas Geraes, Brazil, April 29, 1934, on *Machaerium angustifolium* Vog. and *Machaerium* sp., by Edson J. Hambleton.

This species may be separated from *A. flavipes* Champion by the more rounded outer margins of elytra, the wider costal area, and the shorter first and testaceous third antennal segments.

Tigava lonchocarpa, n. sp.

Allied to *T. cassiae* Drake and Hambleton but distinguished by the thinner and less elevated carinae and the narrower paranota and elytra. Head brownish, the spines testaceous; hind pair of spines long, adpressed, extending beyond front margin of eyes; median spine stout, blunt, directed forward, the anterior pair atrophied. Antennae long, indistinctly pilose; segment I long, stout, constricted before apex, slightly more than three times the length of II, blackish fuscous; II short, concolorous with I; III testaceous, two and a half times as long as IV; IV slightly thickened, clothed with pale hairs, black, the basal portion testaceous. Rostrum extending to middle of mesosternum, brownish, dark at apex; laminae testaceous, constricted on mesosternum, very broad and cordate on metasternum, closed behind. Legs slender, yellowish brown. Body beneath black.

Pronotum grayish brown, moderately convex, finely pitted, tricarinate, all carinae indistinctly areolate; paranota rather narrow, uniseriate behind, biseriate in front, testaceous, the areolae rather small and clear; calli impressed, black; collar raised, narrow, testaceous, areolate; triangular process areolate, lighter in color. Elytra brownish, becoming fuscous within, the marginal area testaceous with clear areolae; costal area moderately wide, biseriate, the outer row a little smaller, subcostal area narrower, biseriate; discoidal area narrowed at base and apex, widest near middle, there four or five areolae deep; sutural area becoming more widely reticulated posteriorly.

Length, 3.85 mm; width, 1.05 mm.

Type (female) and allotype (male) and three paratypes, Viçosa, Minas Geraes, Brazil, May 6, 1934, taken on *Lonchocarpus* sp. by E. J. Hambleton.

T. sesoris Drake and Hambleton is a smaller species with shorter basal segment of antennae.

Campylotingis snipesi, n. sp.

Elongate, slender, brownish, the costal area testaceous, with some of the transverse veinlets fuscous. Head brown, with five moderately long spines, the median arising from a slightly raised area, porrect and dark fuscous, the hind pair adpressed. Rostrum extending between fore legs, the channel strongly constricted on mesosternum, rather wide and closed behind. Body beneath black. Legs long, slender, testaceous. Antennae long, slender; segment I long, stout, constricted before apex, about four times as long as II; II stout, slenderer, testaceous; III very long, slenderest, testaceous, four times the length of IV; IV black, moderately long, scarcely thickened, clothed with whitish hairs.

Pronotum moderately convex, closely pitted, tricarinate, the lateral carinae subparallel, distinct but not prominent, the median a little more raised; calli impressed, brownish, collar raised, areolate; paranota indistinct opposite humeral angles, in front expanded so as to form a distinct carinalike ridge. Elytra narrow, widely constricted beyond middle, the sutural area infuscate, costal area narrow, yellowish brown, the areolae elongate; subcostal wider, mostly biseriate, triseriate in widest part; discoidal area rather narrow, narrowed at base and apex, widest beyond middle, there three or four areolae deep; sutural area becoming more widely reticulated distally.

Length, 3.50 mm; width, 0.07 mm.

Type (male), Viçosa, Minas Geraes, Brazil, collected by Dr. B. T. Snipes. The very narrow paranota opposite calli (there wider and ridgelike) and collar separate this species from its congeners.

Leptodictya paulana, n. sp.

Akin to *L. austrina* Drake and Hambleton in general appearance and color, but separated from it by the smaller areolae of elytra, narrower form and broader paranota. Head tumid, with extremely long, slender testaceous spines.

Antennae yellowish brown to dark fuscous, long, very slender, segment III two and one-half times as long as IV. Paranota completely overlapping, biseriate above, the upper fold broadly rounded in front and not sharply narrowed posteriorly as in *austrina*. Collar at middle jointly raised in front so as to form a tectiform hood, which is slightly more produced in front than in *austrina*. Rostrum extending on metasternum. Elytra with costal area less iridescent, narrower and more closely reticulated than *austrina*. Male narrower than female. Other characters very similar to *austrina*.

Length, 3.00 mm; width, 1.35 mm.

Type (male), allotype (female), Taquaretinga, São Paulo, Brazil, March, 1939, E. J. Hambleton. Paratypes, two specimens taken with type and one specimen, Campinas, São Paulo, June, 1937, Edson J. Hambleton.

Leptobyrsa steini Stål

This species has been very much confounded in the literature by Monte (Papeis Avulsos Dept. Zool. São Paulo 1: 203–208. 1941). The writers' determinations of *steini* have always been based on one of Stål's cotypes kindly sent to us by the Stockholm Museum more than a decade ago. This confusion has been constant since Monte first attempted to identify species in the genus. The same statement applies equally to *L. baccharidis* Drake and Hambleton. Specimens of *Leptobyrsa* before us determined at various times by Monte as his *L. nigricornis* are typical examples of *L. steini*.

Perhaps some of Monte's confusion may be due to the errors in his illustrations of *steini* and *baccharidis* published in the above mentioned volume. His remarks and criticisms seem to be based to some extent on the illustrations rather than a careful study of his specimens. To illustrate, the hood of *steini* in his illustration is distinctly larger than in Stål's cotype and numerous other specimens of this species at hand from Brazil. The hood in *steini* is much smaller and does not cover the entire head (except eyes) or extend beyond its apex. The length and number of spines on the margins of the paranota and elytra in his illustrations agree with our material.

It is impossible to know what Monte has determined as *L. baccharidis*. In the type, type series, and other specimens we do not have a single specimen of *baccharidis* that agrees with Monte's figure. The hood is not so large, the frontal spines are not so long or nearly so long as the first antennal segment, and the lateral carinae are not composed of two very elongate cells. In our series of specimens of *steini*, *baccharidis*, and other members of *Leptobyrsa* Stål, the individuals of a long series of a species exhibit about the same amount of variation as in a number of other species of lace bugs. It is difficult to understand Monte's statement "Porquano tendo coligido para mais de 300 exemplares do que Drake diz ser *steini*, todos eles, sem exceção de um so, apresentam o mesmo recúo que se ve no desenho." It will be necessary to examine specimens of what Monte has called *L. baccharidis*, *L. steini*, and *L. nigritarsis* before these errors can be rectified.

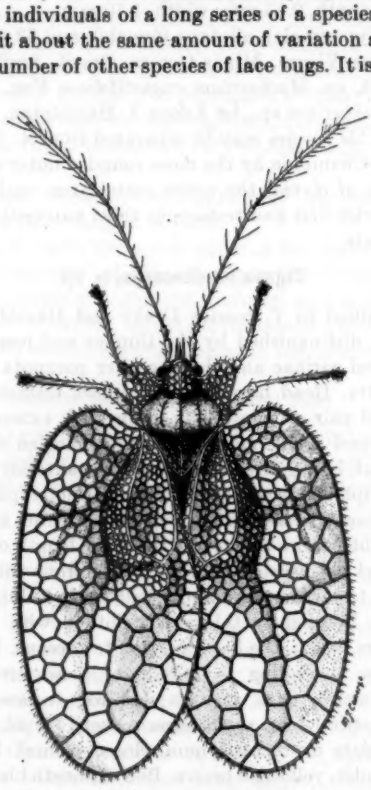

Fig. 1.—*Pleseobyrsa atratarsis*, n. sp.

According to the cotype of *steini* Stål and type of *baccharidis* Drake and Hambleton, the hood of the former is distinctly smaller, and does not entirely cover the head in either form. The margins of the paranota and elytra are clothed with long hairs in *baccharidis* and with

shorter spines in *steini*. The tumid elevations of elytra are also a little higher in *baccharidis*.

Pleseobyrsa atratarsis, n. sp. Fig. 1

Very similar to *P. plicata* (Champion) but differs from it in having black-fuscous tarsi, smaller hood. The lateral carinae are distinct, but present only on the disk. Head with five long, slender, pale, testaceous spines, the hind pair adpressed, extending as far forward as base of front pair of spines. Subcostal and discoidal areas subequal in width, each with five rows of areolae in widest part, the discoidal area considerably elevated. Paranota mostly finely serrate, with a few spines on the anterior margins. Head moderately convex above, brownish; front pair of spines straight, not quite reaching apex of first antennal segment median a little shorter, all three frontal spines directed forward and slightly upward. Other color and other characters very similar to *plicata*.

Length, 3.60 mm; width, 2.70 mm.

Type (female), Poças de Caldas, Minas Geraes, Brazil, Col. O. W. Guilherme, July 1, 1939.

Gargaphia munda Stål

The determinations of *munda* Stål of the writers are based upon a cotype kindly sent us a number of years ago by the Stockholm Museum. Many other specimens are also at hand from the states of Minas Geraes, São Paulo, and Rio de Janeiro, collected by Edson J. Hambleton. Several years ago, Monte kindly sent the senior author specimens under the names of *G. munda* Stål and *G. trichoptera* Stål of what he later described as *brunfelsiae*. This probably accounts for Monte's erroneous statement relative to *munda* in Arq. Inst. Biol. 2: 295. 1940. Later Monte changed his determination and then distributed what he had wrongly identified as *munda* and *trichoptera* under the label *brunfelsiae*. The latter is a valid name for a good species.

Gargaphia lanei Monte

Gargaphia lanei Monte, Arq. Zool. Estado São Paulo 1: 376. 1940.
Gargaphia limata Drake and Poor, Rev. Ent. 2: 228. 1940.
Gargaphia limitata Monte, Arq. Zool. Estado São Paulo 2: 18. 1940.

According to the dates indicated in the original description, *lanei* Monte appeared on June 27, 1940, and *limata* Drake and Poor on June 28, 1940. If these journals were mailed as indicated, *lanei* Monte has date priority of one day and is the valid name of the species. A study of type material shows that the two names apply to the same species and the name *limata* Drake and Poor must be suppressed.

Gargaphia implicata Drake and Hambleton

Gargaphia concursa implicata Drake and Hambleton, Rev. Ent. 1: 535. 1940.

After studying a large number of specimens, the authors believe that the narrower, bi- or triseriate, subangulate paranota opposite humeri and the almost uniformly rounded (not distinctly arched) median carina represent specific differences. The hood is also larger and much more inflated than in *concursa* Drake. The subcostal area is either bi- or triseriate. The type is a female and allotype, male. There are 21 paratypes. Other specimens are also before us from Brazil, Paraguay, and Argentina.

Gargaphia nigrinervis impedita, n. var.

Separated from typical *G. nigrinervis* Stål by the distinctly narrower, subrounded angles of paranota opposite humeri. Paranota triseriate in widest part, the areolae large, hyaline. Median carina foliaceous, uniseriate, not distinctly arched, slightly more elevated behind. Color and other characters very much like *nigrinervis*.

Length, 4.20 mm; width, 2.25 mm.

Type (male), Río Frío, Colombia, April 2, 1926.

In *G. nigrinervis* Stål the paranota opposite humeral angles are wider and produced into acute points, there four or five areolae deep. In *G. deceptiva* (Drake) the paranota angles are very similar to *G. nigrinervis* Stål but the median carina is very strongly elevated, strongly arched behind hood, and very much higher than in *impedita* or *nigrinervis*.

Dyspharsa, n. gen.

Head very short, with five spines. Antennae very slender, long, indistinctly pilose; segment I short and a little stouter and longer than II; III very long, slenderest; IV slightly thicker than III. Rostral channel widening posteriorly, the rostrum moderately long. Bucculae closed in front, areolate. Orifice present. Eyes placed close to pronotum. Pronotum strongly convex,

pitted, unicarinate. Hood rooflike, covering base of head. Paranota narrow, linear. Legs slender. Elytra distinctly lacy, expanded near the base, divided into usual areas; discoidal area short, not reaching middle of elytra.

Type of genus, *Leptopharsa myersi* Drake.

This genus resembles in general appearance very closely *Acysta* Champion but it has a distinct hood. The pronotum is sharply convex and highest at center of disk, unicarinate. The discoidal area is short. These characters will also separate it from *Leptopharsa* Stål. In the latter, the pronotum is more or less transversely convex.

Leptopharsa perbona Drake

Leptopharsa perbona Drake, Amer. Mus. Nov., No. 398: 2. 1930.
Leptopharsa spectabilis Monte, Arq. Inst. Biol. **11**: 290, fig. 7. 1940.

As it is impossible to separate *perbona* Drake and *spectabilis* Monte, the latter name should be placed in synonymy. The species is not very closely related to *G. munda* Stål, either in appearance or structure.

Leptopharsa distinconis Drake

Leptopharsa distinconis Drake, Iowa State Coll. Journ. Sci. **3**: 54. 1928.
Leptopharsa iridis Drake, Amer. Mus. Nov., No. 398: 2. 1930.

Numerous specimens of this insect were collected at Pirassununga, São Paulo, March 30, 1936, and Belém, Pará, October 9, 1938. The variations in these series and other examples make it impossible to distinguish *distinconis* and *iridis* and the latter name is here placed in synonymy.

Leptopharsa satipona, n. sp.

Small, whitish testaceous, the head black, the pronotum darkened. Head with five long, slender, testaceous spines, the hind pair curved downward. Antennae very long, slender, smooth; segment I very long, black, slightly more than three times as long as II; segment II short, black-fuscous; III testaceous, very long, slightly more than twice as long as IV; IV very long, slightly thickened, blackish, with short, pale hairs. Legs testaceous, slender. Rostrum extending slightly beyond mesosternum. Body beneath black.

Pronotum moderately, transversely convex, pitted, tricarinate; collar raised, the marginal row of areolae whitish testaceous; paranota rather narrow, reflexed, oblique, projecting upward, whitish testaceous, biseriate, the outer margin nearly straight, the areolae hyaline; lateral carinae very low; median carina more elevated, not areolate; posterior triangular projection reticulate, pale testaceous. Elytra constricted beyond middle, some of the veinlets fuscous; costal area moderately wide, mostly biseriate, triseriate in widest part, the areolae rather small; subcostal area very narrow, biseriate, the areolae tiny; discoidal area short, narrower in front than behind, widest a little beyond middle, there five areolae deep; sutural area with distal areolae larger and some of the veinlets brownish.

Length, 2.70 mm; width, 1.00 mm.

Type (male), Satipo, Perú, August 9, 1941, P. Paprzycki.

This is one of the very smallest members of the genus. The broad costal area and very long antennae separate it from the other smaller species of the genus.

Stephanitis parana, n. sp.

Moderately large, strongly widening posteriorly, the nervures brownish testaceous, the areolae hyaline and somewhat iridescent. Head, save eyes, concealed by the hood, brownish. Antennae very long, slender, shortly pilose, testaceous, the last segment dark fuscous; segment I moderately stout, long, broadly constricted before apex; II short, one-fourth the length of I; III long, slenderest; IV extremely long, scarcely thicker and three-fourths the length of III. Rostrum long, yellowish, black at tip, practically as long as channel. Legs very long, slender, testaceous. Orifice distinct.

Pronotum slightly convex, pitted, black, the triangular portion areolate and testaceous: lateral carinae present on disk, testaceous, rounded above, with three or four hyaline areolae; median carina very high, practically as high as hood, with top margin rounded, mostly biseriate, with areolae large and hyaline, the marginal nervure and some of transverse veinlets fuscous. Hood moderately large, inflated, extending a little before apex of head, slightly compressed laterally, the areolae hyaline. Paranota very wide, reflexed obliquely upward, the outer margin rounded, the areolae moderately large and hyaline. Elytra divaricating posteriorly, their apices widely separated when at rest the costal margin broadly

rounded; costal area very wide with large areolae, five deep in widest part; subcostal area biseriate adjacent to discoidal; discoidal area short, extending about one-fourth of its length beyond apex of triangular process of pronotum, obovate in shape, three areolae deep in widest part, areolae of sutural area subequal in size to those of costa.

Length, 3.60 mm; width, 2.00 mm.

Type (male), allotype (female), and two paratypes, Pará, Brazil, October 9, 1938, taken by E. J. Hambleton and H. F. G. Sauer.

This species is not easily confused with other members of the genus. The lateral margins of elytra are not clothed with hairs, the antennae indistinctly pilose, the discoidal area less raised or inflated, and the general color of nervures darker than in other Brazilian species.

Corythucha globigera Breddin

Corythucha globigera Breddin, Soc. Ent. **16**: 81. 1901.

Type (male), Santa Inez, Ecuador, R. Haensch, Breddin collection, which was kindly sent us by the late Dr. Walter Horn, of the Berlin Museum. Numerous specimens, Lima, Perú, April 25, 1936.

Hood large, strongly inflated behind, abruptly constricted near the middle and sharply narrowed anteriorly. Elytra with moderately large, tumid elevation, the costal area triseriate. Two spots on each paranotum, one or two spots on tumid elevation, a transverse band near base and another near apex of elytra, dark fuscous; apical band of elytra sometimes more or less obsolete. Hood somewhat infuscated. Median carina about one-third as high as hood, slightly arched in front, mostly uniseriate, usually with two or three areolae divided at highest part; lateral carinae distinct. Margins of paranota, elytra, and some of veinlets of hood, elytra, and median carina beset with short spines.

ENTOMOLOGY.—*Some genera of flies of the family Syrphidae.*[1] FRANK M. HULL, University of Mississippi. (Communicated by ALAN STONE.)

Recent studies of syrphid flies have disclosed several forms that do not appear to belong properly in any present genera. These are based upon undescribed species. In addition, I now find that the fly *Meromacrus vittata* Hull described several years ago should be assigned to a new genus for reasons given below.

Lycopale, n. gen.

Medium-sized flies of the subfamily Eristalinae with bright-yellow, flattened tomentum upon the thorax, bare eyes, and open marginal cell. Antennae short, the third joint oval, with dorsal arista. Front tomentose. Face with abundant pubescence and some pile, obscuring the ground color. Thorax black, pollinose, with thick, rather long, and dense tufts of yellow tomentum along the suture and edge of humerus. Scutellum simple. Abdomen oval, rather convex, the color metallic black, the pile rather appressed and short. Wings with helophiline venation and a prominent dip in the third vein. Anterior margin brown; marginal cell widely open. Legs simple, the hind femora a little thickened and having a patch of spinules at its base.

Genotype: *Meromacrus vittata* Hull.

This genus is related either to *Meromacrus* Rondani through its tomentose pile or to *Helophilus* Meigen through its open marginal cell and vittate thorax. The latter relationship seems more probable. The genus differs considerably in its facies from *Helophilus;* the abdomen is much more convex than in our northern broad and flattened species of that genus, and has besides the same peculiar pile which characterizes *Meromacrus.*

Kryptopyga, n. gen.

Eyes of male very widely separated, the upper half of occiput extraordinarily tumid and swollen but not rounded posteriorly. The rounded, swollen, anterior part ends in a rim that marks the edge of a deep, concave cup. Face practically vertical, a little vertical below. Antennae unusual, very elongate and slender. The first joint is long; the second joint is so short as to be almost overlooked; the third is very long, at least three times as long as the first and densely long, erect pilose on one side; the dorsal arista is practically eliminated, a

[1] Received September 15, 1943.

minute spurlike remnant being all that remains. Thorax not unusual. Scutellum broad and narrow without spur, spine, or indentation. Abdomen elongate, a little attenuated basally. The third and fourth segments are greatly dilated into a subquadrate club; the fourth segment takes the form of a vertical, downward directed, expanded hypopygium; this pseudohypopygium is hidden between the overlapping sides of the third segment; the true hypopygium can be barely seen from a ventral aspect. Legs small and weak, the hind femora spindlelike and microdontine. Venation typically microdontine.

Genotype: *Kryptopyga pendulosa* n. sp.

This genus is closely related to the odd African *Ptilobactrum* Bezzi. It is distinguished from it chiefly by the subpetiolate abdomen and the elongated pseudohypopygium.

Kryptopyga pendulosa, n. sp.

Male.—Length 12 mm excluding antennae; antennae 5.3 mm.

Head: the occiput and vertex exceedingly bloated and tumid; the eyes broadly separated, the posterior margin of occiput sharp and shelving instead of rounded. Face bulbous on the lower portion, in ground color light brown becoming brownish yellow ventrally and along the sides, leaving the middle broadly darker brown. Pile of face pale, shining brassy and appressed. The vertex and upper part of front are dark shining brown with short pale pile; the area immediately above the antennae and on its sides is shining chestnut-brown and bare. Antennae extremely long and pendulous. The first joint is slightly curved, flattened upon the inner surface, barely over one-fourth as long as the third joint; the second joint is minute and buttonlike and about one-eighteenth as long as the third joint; third joint slender, enlarged just before the blunt apex, 4 mm long, and upon the outer half thickly clothed with long, erect, delicate, dark-brown pile. The arista is a mere spur, located a short distance from the base of third joint. Eyes bare.

Thorax: dark, dull brownish black, with faint trace of the darker brown, pair of slender, widely separated, medial vittae that are confluent a short distance before the scutellum. Outside of this pair of vittae on each side there is a wide, longitudinal stripe of appressed, golden pile, reaching almost to the scutellum and crossing a slender transverse band of similar pile running along the transverse suture, which, however, extends only a short distance inward medial to the longitudinal stripe. Posterior margin of humeri banded with similar pile. Scutellar margin almost evenly rounded but actually very bluntly protuberant in the middle; its color yellowish brown.

Abdomen: elongate, club-shaped, scarcely narrowed basally, the third segment slightly wider than the basal half of the abdomen. First segment elongate, pale brown, subtranslucent, strongly transverse striate, darker brown upon its anterior corners and concolorous posteriorly with the basal half of the rather long second segment. Second segment darker brown posteriorly. Third segment barely longer than the first two segments, dark brownish black, produced downward into an enormous, thickened club, the fourth segment actually vertical and thrust downward, simulating a false hypopygium. The false hypopygium is actually concealed by the third segment which is so curved around that only a small opening is visible ventrally by turning the fly upside down. The third segment of the venter is produced into a curious shield-shaped overlapping flap, which serves still further to close off the genitalia.

Legs: dark reddish brown, blackish upon the basal half of the hind femora, extensively upon the middle femora. Anterior femora more reddish brown. Anterior tibiae basally and almost the whole posterior tibiae reddish brown; elsewhere these and the middle tibiae are blackish; there is silvery pollen upon the tibiae in several places. Hind femora moderately thickened, spindly upon the basal half.

Wings: strongly tinged with brown, with heavy stigmal cross vein, well developed vena spuria and a strong brown patch, diffuse-edged, occupying part of the apex of the wing.

Holotype.—One male. Soekaboemi, Java, May 1926, purchased from E. Le Moult, 1933-189. In the British Museum of Natural History.

Remarks.—This fly is related to the African *Ptilobactrum* Bezzi, in which, however, the antennae are not so long nor is the abdomen elongate nor does it terminate in such a peculiar fourth segment. In the females of *Ptilobactrum* the antennae are without the plushlike pile. *Kryptopyga* differs from *Paramixogaster* Brunetti in the presence of the long pile upon the

antennae of the male. The antennae of that genus are bare in the male and lack the curious development of the abdomen, although the abdomen is pedunculate. There are several Australian species with elongate but nonhairy antennae and with normal abdomen.

Genus **Spheginobaccha** de Meijere

DEXIOSYRPHUS, n. subgen.

Elongate flies of medium size or larger. The head is subglobular, the occiput tumid, swollen, and rounded. Eyes narrowly separated, approximated about halfway between ocelli and antennae in the male. Antennae short, the third joint oval with dorsal arista. Face retreating with a barely suggested tubercle. Occiput deeply incised at a point on either side near the top. Thorax almost bare, the pile microsetate. Transverse suture produced as a complete deep crease across the whole of the mesonotum. Abdomen elongate, subcylindrical, and slightly attenuated. The legs have the hind femora slender, their base tapered and spindle-formed, their apex without trace of spines. Wings heavily villose. Marginal cell widely open; apical cross vein spurred below. There is no upward spur from the last section of the fourth longitudinal vein below the end of vena spuria.

Type of subgenus: *Spheginobaccha* (*Dexiosyrphus*) *funeralis*, n. sp.

This subgenus is related to *Spheginobaccha* de Meijere. It differs in the presence of the deep crease across the mesonotum and the virtual absence of the upward spur from the fourth vein.

Spheginobaccha (Dexiosyrphus) funeralis, n. sp.

Male.—Length 14 mm; wing 10 mm.

Head: subglobular, the occiput tumid and strongly developed posteriorly adding to the globular shape of the head. There is a strong, submarginal crease in the occiput a short distance down on each side of the eye margins which from above appears as a V-shaped fissure on the back of the occiput. Occiput and vertex and face and front black in color, the occiput grayish white pollinose. Ocelli set well forward close to the point of approximation of the eyes; the eyes fail to meet by a distance equal to the width of the posterior ocelli. There is a low facial tubercle near the middle of the face and the cheeks are almost absent. Antennae short, the third joint large, oval, about one-half again as long as wide, the arista short, slender except at the extreme base; first antennal joint dark brown, second and third light brownish orange. Pile of face, front, and vertex black, of the posterior occiput above and below whitish in color.

Thorax: dark black, dully shining with on each side a rugose stripe which at the level of the posterior humeri broadly diverges and is hence continued as two stripes almost to the end of the thorax. Pile of thorax very short, almost microscopic. Scutellum and pleura black, the former with a few rugae, the posterior margin of the mesopleura and the whole ventral part of the pteropleura with thick silvery pollen.

Abdomen: very long, somewhat slender, narrower than the thorax, slightly club-shaped on the third and fourth segments, subcylindrical in shape; the first, whole of the second, and base of the third segment with numerous very fine transverse linear grooves or furrows. On the sides of the second segment just before the middle, submarginal in position, is a pair of small, oval, diagonal, silvery pollinose spots, pointed at each end. Abdomen black and chiefly shining; the sides of the long second and third segment, which are together practically as long as the remainder of the abdomen, are quite parallel; sides of second segment emarginate; on the sides of the third and fourth segment, widely separated in the middle is a pair of slender diagonal pilose and pollinose-margined hair-bands.

Legs: almost wholly light reddish brown, the base of the hind femora, the basal third or half of all of the tibiae pale yellow, the hind femora slightly thickened, the pile everywhere very fine and exceedingly sharp-bristly and flat-appressed.

Wings: pale brown. There is no spur from the third longitudinal vein, no stigmal cross vein, the vena spuria is well developed, the wings are uniformly villose, the terminal sections of the subapical and postical cross veins are almost straight and slightly wavy in the latter.

Holotype.—One male. South Africa, R. E. Turner 1933-69; East Cape Province, Katberg, 4,000 feet, XII, 1932. In the British Museum.

Spheginobaccha dexioides, n. sp.

Distinguished from *S. macropoda* Bigot by the replacement of the yellowish, translucent, subtriangular spots of the abdomen with slen-

der, diagonal, gray-pollinose bands, most conspicuous upon the fourth segment.

Male.—Length 14 mm; wing 10 mm.

Head: occiput tumid, silvery gray pollinose, the crease very conspicuous. Vertex shining brown, somewhat convex, becoming light chestnut-brown on a wedge behind the ocelli. Eyes approximate, failing to touch by a distance equal that between the posterior ocelli. The front is shining brown. Face dark brown, shining. There is a narrow, transverse band of yellow pubescence across the face at the epistoma and up narrowly along the eye margins. Antennae short, wholly reddish brown, the third joint about twice as long as wide, dully pointed. Eyes bare.

Thorax: black, feebly shining; microscopically pilose, mixed black hairs among brownish yellow hairs. There is a rugose area on each light-brown humerus, and on each medial edge of the humerus there is a similar area that immediately divides to form slender stripes running the greater part of the thorax. Scutellum broad, very convex, dark brown. The pleura are black with a narrow, vertical, silvery stripe. There is a tuft of long, golden-yellow hair on the anterior margin of the propleura. Squamae rather short, pale in color.

Abdomen: rather elongate, basally petiolate, the first and second segments and the basal third of the third segment with almost parallel sides. Actually the first segment is a little wider than the second and the club-shaped fourth segment and terminal part of the third segment are three times as wide as the second segment. Abdomen subcylindrical, the fourth segment considerably longer than the third segment, the third segment barely shorter than the second segment. Abdomen shining black, chiefly dark brownish black on the fourth segment, with a diagonal, grayish-silvery pollinose stripe on the sides of the second segment before the middle, widely interrupted. There is a similar diagonal stripe in the opposite direction on the third segment and on the fourth segment a diagonal, subbasal, silvery-gray stripe practically continuous across the middle. Pile of abdomen flat, bristly, black except on the light pollinose area where it is pale yellowish. Sides of third and fourth segments strongly curved over.

Legs: chiefly dark brown, the base of all the femora, the basal third of all the tibiae yellowish. The apical half of the anterior femora beyond the strong basal bulge and bend are light reddish brown. Hind femora slightly thickened basally.

Wings: nearly hyaline, clear brownish along the anterior marginal edge to the end of the costa. Third longitudinal vein straight without spur into the first posterior cell. There is a spur from the fourth longitudinal vein into the first posterior cell near the end of the vena spuria.

Holotype.—One male. Port St. John, Pondoland, November 1923, South Africa, R. E. Turner, 1924-6. In the British Museum.

ZOOLOGY.—*Zoeal larvae of the blue crab* Callinectes sapidus *Rathbun.*[1]

MILDRED SANDOZ, Virginia Fisheries Laboratory, and SEWELL H. HOPKINS, Texas A. and M. College. (Communicated by WALDO L. SCHMITT.)

In 1942 eggs of the blue crab were hatched in the laboratory under favorable and unfavorable environmental conditions. Controlled experiments showed that under favorable conditions blue-crab eggs hatch into normal first crab zoeae. Eggs heavily infected with fungi or bacteria and those kept under unfavorable salinity and temperature conditions either failed to hatch or hatched into prezoeae that usually died soon. The optimum salinity range for hatching was found to be about 23 to 30 parts per thousand. Eggs failed to hatch outside the temperature range of 19°–29° C. Churchill (1942) concludes that there is a prezoeal stage in the blue crab. Our data clearly show that occurrence of prezoeae after hatching is not a normal one, but a result of development under unfavorable environmental conditions. Williamson (1910), working on *Portunis puber*, also of the family Portunidae, states that the larvae were obtained in the first zoeal stage.

[1] Received January 19, 1944.

In studies on development the first three zoeal stages were reared in the laboratory. The first and second zoeae were found to correspond with the descriptions and drawings of these larvae by Hopkins (1943) and in most respects with the characteristics presented by Churchill (1942). The third zoeae, however, showed marked differences from the third zoeae described by Churchill (1942). The three significant morphological differences are: (1) There are eight swimming setae on the exopodites of the first and second maxillipeds; (2) the exopodite of each antenna is still short as in the second zoea, not prominent as in Churchill's third stage; and (3) there are no strong dorsal spines on the fifth abdominal segment. Churchill states that (1) the exopodite of the first maxilliped has six setae and the second maxilliped has seven; (2) each antenna bears a prominent exopodite; and (3) there appears for the first time a pair of large strong spines on the dorsal side of the fifth segment. He figures a prominent chromatophore in the basipodite of the first maxilliped of the third stage, but his fourth and fifth stages lack a corresponding chromatophore. This phenomenon, if true, is most unexpected, since carcinologists appear to agree on the constancy of pigment characters for purposes of larval identification (Williamson, 1910, and Behre, 1941).

Churchill's description of the third stage is based on zoeae collected in plankton tows and not on larvae reared under observation. It represents a zoeal stage of another crab. Also, his fourth and fifth stages do not seem to be larvae of the blue crab.

As pointed out by Hopkins (1942), the fact that other portunid crabs are known to occur in the lower part of the Chesapeake Bay and in the ocean just outside of the bay makes it seem dangerous to draw too definite conclusions as to the identity of the zoeal stages on a basis of plankton tows alone.

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PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

ANTHROPOLOGICAL SOCIETY

The Anthropological Society of Washington at its annual meeting held on January 18, 1944, elected the following officers: President, T. DALE STEWART; Vice President, REGINA FLANNERY; Secretary, WILLIAM N. FENTON; Treasurer, WALDO R. WEDEL; Members of the Board of Managers, W. M. COBB, WM. H. GILBERT, H. W. KRIEGER, ALFRED MÉTRAUX, JULIAN H. STEWARD.

A report of the membership and activities of the Society since the last annual meeting follows:

Life members, 1; active members, 53; associate members, 13; total, 67. This represents an increase of 13 over last year.

The members elected during the year were: Dr. GORDON T. BOWLES, Mrs. MARION HALE BRITTEN, Dr. EDWIN G. BURROWS, Miss ELIZABETH PEARSON CLARK, JOHN HADLEY COX, Dr. JAMES A. FORD, PHILIP EDWARD FOWLER, Mme. NADYA GEORGES-PICOT, Dr. KATHERINE LUOMALA, Dr. A. MÉTRAUX, Dr. MAURICE A. MOOK, Miss RUTH E. PARDEE, ROBERT L. RANDS, Dr. DEMITRI B. SHIMKIN, Dr. GORDON R. WILLEY, active members; Mrs. MARJORIE LISMER BRIDGES, Capt. WENDELL P. ROOP, U.S.N.R., Dr. AFIF I. TANNOUS, Lt. Col. GEORGE WILLIAMS, associate members.

Two members, Dr. ALEŠ HRDLIČKA, life member, and Dr. SOPHIE NORDHOFF-JUNG, associate member, were lost by death. The Society voted to record its deep sense of loss at the death of these members and to extend its sincere condolences to their relatives.

The Treasurer's report is as follows:

Funds invested in Perpetual Building Association (with interest to date)	$1,762.92
21 shares Washington Sanitary Improvement Co. No. 505 (par value $10 per share)	210.00
2 shares Washington Sanitary Housing Co., No. 222 (par value $100 per share)	200.00

U. S. Saving Bond, Series G., No. D96697G	500.00
Cash in bank	399.52
	$3,072.44
Bills outstanding:	
To American Anthropological Association (subscriptions to American Anthropologist for 18 members at $5 each)	90.00
To Cosmos Club	23.40
	$2,959.04
Total as of January 18, 1944	2,836.50
Increase	$122.54

Division of annual surplus:

	Previous	*1944*	*Total*
Publication fund	$102.22	40.84	143.06
Speakers' fund	102.23	40.85	143.08
Investment fund	102.24	40.85	143.09

The Society acted as host to the American Anthropological Association at the annual business meeting of the latter on December 7, 1943, at the Cosmos Club.

All regular meetings were held at the U. S. National Museum. Continuing the practice adopted in 1942, the mailing list has been kept current so as to include all anthropologists in Washington; 160 notices were sent out for regular meetings.

The Society has been the gainer by the influx of scientific workers to Washington. No difficulty has been encountered in enlisting interesting speakers, and offerings have reflected a policy of keeping our science abreast of world problems at home and abroad. Areas represented were Latin America (2 papers), Oceania (1), India (1), and North America (2); and problems ranged from the Japanese in America to caste in far-off India; from Shoshonean children to music in Polynesia. We have endeavored to keep anthropology alive for those whose careers are momentarily diverted. Two of the papers presented have been published.

The papers presented before the regular meetings of the Society were as follows:

January 19, 1943, 711th meeting, Dr. RALPH BEALS, *Acculturation in Mexico.*

February 16, 1943, 712th meeting, Dr. DAVID G. MANDELBAUM, *Some aspects of social organization in India.*

March 16, 1943, 713th meeting, Dr. JOHN F. EMBREE, *The Japanese in America.* (Published in this JOURNAL **33** (8): 238–242. Aug. 1943, under the title *The relocation of persons of Japanese ancestry in the United States: Some causes and effects.*)

April 20, 1943, 714th meeting, Dr. DEMITRI B. SHIMKIN, *Personalities and social interactions among Wind River Shoshone children.*

October 19, 1943, 715th meeting, Dr. WILLIAM DUNCAN STRONG, *Cross sections of New World prehistory—A brief report on the work of the Institute of Andean Research Program, 1941–1942.* (Published in full in Smithsonian Misc. Coll. **104** (2): 46 pp., 33 pls. 1943.)

November 16, 1943, 716th meeting, Dr. EDWIN G. BURROWS, *Music in Polynesian culture.*

The regular December meeting was omitted in favor of meeting with the American Anthropological Association at its annual business meeting.

WILLIAM N. FENTON, *Secretary.*

Obituaries

CHARLES FREDERICK MARVIN, long-time chief of the U. S. Weather Bureau, passed away on June 5, 1943, in Washington, D. C., at the age of 84, after 50 years of government service followed by almost 10 years in retirement with well-earned time for his personal pursuits. Death followed a brief illness subsequent to a minor operation. Dr. Marvin was born in Ohio, in the city now called Zanesville, on October 7, 1858, son of Charles F. and Sarah A. (Speck) Marvin. His education was acquired almost entirely in Columbus, Ohio, first in the public schools of the city and finally in the Ohio State University, where he received his degree in mechanical engineering in 1882 and later the honorary doctor of science (1932). During the four years just preceding his graduation, he served as instructor in the mechanical and physical laboratories of the university.

Dr. Marvin enjoyed an unusually well-ordered and consummate life. He entered the employ of the Federal Government soon after his graduation when he was appointed a junior professor in the Signal Service of the Army in 1884. When the meteorological work of that organization was transferred to the Weather Bureau in 1891, Dr. Marvin went with it. His early work with the Bureau as professor of meteorology was related primarily to design and maintenance of meteorological instruments, an interest that he retained throughout his active career. For several years preceding his selection to head the Weather Bureau, he was the head of its instrument division. In

1913, on recommendation of the National Academy of Sciences, he was appointed chief. With 21 years to his credit in the highest position in the Bureau, he retired in 1934 to pass several happy years with his family in private life, free from the problems of public administration and the complexities of meteorological questions.

Dr. Marvin's span of service encompassed a most interesting and important period in the evolution of meteorological science and the Weather Bureau. He entered the work in an hour of opportunity, during one of the recurring phases in meteorology when the public interest in vital weather information creates the demand that something be done about it. Apropos is a reference from the account by Prof. T. C. Mendenhall, published by Dr. W. J. Humphreys in his *Biographical memoir of Cleveland Abbe.* In referring to the importance of a theoretical investigation of the general principles of meteorology with a view to improvements in weather forecasting it is stated that: "The vitalization of the service through these important changes resulted, happily, in the acquisition of such young men as Marvin, Fassig, McAdie, Morrill, McRae, Russell and a number of others, some of whom are still in the service (1919) and from several of whom have come in later years contributions to the science of meteorology of very great value."

During his early years in meteorology, Dr. Marvin contributed greatly to improvements in design of meteorological instruments and increase in exactness of measurements. He pioneered in instruments to measure upper air conditions by means of kites, as witness the Marvin meteorograph and the Marvin treatise on kite design. These constituted an early approach to the research in aeronautical meteorology that has become a primary responsibility of the Weather Bureau since modern aviation came into its own toward the close of Dr. Marvin's career. He worked on many other instruments—the Robinson cup anemometer for wind velocity, the barometer and barograph for recording atmospheric pressure, and instruments for measuring evaporation, rainfall, snowfall, sunshine, cloudiness, air temperature, and humidity. His humidity equations and tables based thereon are still in common use to determine moisture content of the air. His work included design of a seismograph long used in the Weather Bureau.

Dr. Marvin's scientific interest and his position in the Bureau led him into many other activities and relationships. Among the scientific organizations in which he took an active part at one time or another and held leading office were the National Advisory Committee for Aeronautics, the Washington Academy of Sciences, the Philosophical Society of Washington (president 1903), and the American Meteorological Society (president 1926). He was also a member of the Cosmos Club. He represented the United States in important international scientific meetings. In 1928 he was knighted by the King of Norway in recognition of aid given by the Weather Bureau in Amundsen's Arctic explorations, and in 1934 he was a delegate to the League of Nations, Genoa. He was actively interested in calendar reform and devoted much time and study to the logical presentation of his views.

Surviving are a son, Charles F. Marvin, Jr., two daughters, Mrs. Claude Livingston and Mrs. Park Norwood, and a host of friends acquired during his many kindly and considerate associations in the more than half century of his eventful life.

F. W. REICHELDERFER

After a brief illness EDWARD HALL BOWIE passed away on July 29, 1943, at his home in Berkeley, Calif., following more than 50 years of service dedicated to his chosen science of metereology. He was born at Annapolis Junction (near Bowie), Md., on March 29, 1874, and attended St. John's College, Annapolis, Md., later receiving the degree of master of science from that institution. In December, 1891, he entered the Weather Bureau shortly after it had been transferred from the Signal Corps of the Army to the Department of Agriculture. He served at Memphis, Tenn., Montgomery, Ala., Dubuque, Iowa, Galveston, Tex. St. Louis, Mo., Washington, D. C., and San Francisco, Calif. While at St. Louis his ability in forecasting first attracted attention, and as a result he was assigned to the Washington, D. C., office, where he served as forecaster from 1909 to 1924. He was then selected to administer the important forecast district comprising the Pacific States.

His service at Washington included the period of World War I, during which he was commissioned a major in the Signal Corps, U.S.R., serving overseas with that organization in developing and inaugurating a meteorological service for the A.E.F. In this work he took an active part in furnishing advices for aviation, shipping, submarine patrols, gas and flame service, and general operations, including the making of extended forecasts.

His interest in meteorology and especially in weather forecasting induced him to accomplish a prodigious amount of reading in these fields. Few have studied the daily weather charts with greater assiduity and understanding. As a result he made many contributions to forecasting knowledge, to be found chiefly in the Monthly Weather Review and other publications of the Weather Bureau. Among these were "Methods for Predicting the Movements of Cyclones, etc.," "Types of Storms in the United States, etc.," "Types of Anticyclones of the United States, etc.," and "The Formation and Movement of West Indian Hurricanes." In addition he was a member of the board of editors of a book entitled *Weather forecasting in the United States*, a pioneer publication of its kind. His contributions to the technique of making extended forecasts from synoptic Northern Hemisphere charts attracted favorable comment.

In 1936 he visited most of the organized weather services of the Far East for the purpose of increasing the number of weather observations available for the benefit of ocean navigation. Following this survey he was designated as representative to the Southwest Pacific Meteorological Commission held at Wellington, New Zealand. A voyage on board the French Merchant Marine Training Ship, the *Jacques Cartier*, at the request of the French Government, made it possible for him to suggest improvements looking to increased availability of radio weather reports from ships at sea in the North Atlantic.

For some years, especially during the early period of its development, he took an active part in the deliberations of the Meteorological Section of the American Geophysical Union and served as president of the section of meteorology and later as a member of the Special Committee on Meteorology and Hydrology. At the time of his death he was president of the American Meteorological Society. He was also a member of the Washington Academy of Sciences, the Philosophical Society of Washington, and the Royal Meteorological Society (London).

Major Bowie put his whole heart into any project he undertook and pursued it with energy and vigor to its conclusion. Progressive and quick to make decisions, his alert mind and broad vision, bulwarked by an unusual background of meteorological experience, caused his advice and counsel to be much sought. The impress of his influence will be felt for many years to come. He was admired and respected by all with whom he came in contact. He is survived by his widow and three married daughters.

R. H. WEIGHTMAN